gdc

COASTAL ENVIRONMENTAL ANALYSTS

13 January 1999

Mr. Carl Goldstein
American Samoa Program Manager
Office of Pacific Islands
and Native American Programs
U.S. Environmental Protection Agency
75 Hawthorne Street
San Francisco, CA 94105

Ms Sheila Wiegman
American Samoa
Environmental Protection Agency
American Samoa Government
Pago Pago, American Samoa 96799

Re: Effluent Chemistry (June 1998 and November 1998 Sampling Episodes)
StarKist Samoa (NPDES Permit AS0000019)
COS Samoa Packing (NPDES Permit AS0000[illegible]
Re: Effluent Bioassay Reports (June 19[illegible] [illegible]ove[illegible] [illegible]ng Episodes)
StarKist Samoa (NPDES P[illegible]
COS Samoa Packing (NP[illegible]

4 Technical Reports in Box w/ All [illegible]

EFFLUENT DATA

Dear Carl and Sheila:

Enclosed are two copies each of the [illegible] [illegible]ports for the effluent chemistry for each of the canneries. Al[illegible] [illegible]mber 1998 effluent bioassay reports for the combined effluent from th[illegible] [illegible]esent the 11th and 12th semi-annual testing episodes for each of the canne[illegible] [illegible]r to the testing over the previous six years.

Sincerely,

(originals signed by)
Steven L. Costa, Ph.D.

enclosure 1: Chemical Analysis of Effluent: - June 1998 Sampling - StarKist Samoa
enclosure 2: Chemical Analysis of Effluent: - June 1998 Sampling – COS Samoa Packing
enclosure 3: Chemical Analysis of Effluent: - November 1998 Sampling - StarKist Samoa
enclosure 4: Chemical Analysis of Effluent: - November 1998 Sampling - COS. Samoa Packing
enclosure 5: Bioassay Testing of Effluent: - June 1998 Sampling
enclosure 6: Bioassay Testing of Effluent: - November 1998 Sampling

cc: Barry Mills/StarKist Foods (w/enclosures 1, 3, 5 and 6)
Jim Cox/COS International (w/enclosures 2, 4, 5 and 6)
Plant Manager/StarKist Samoa (w/enclosures 1, 3, 5,and 6)
Herman Gebauer/COS Samoa Packing (w/enclosures 2, 4, 5 and 6)
David Wilson/CH2M Hill/SEA (w/ all enclosures)
Mike Mowatt/CH2M Hill/SFO (w/o enclosures)

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13 January 1999

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Re: Effluent Chemistry (June 1998 and November 1998 Sampling Episodes)
StarKist Samoa (NPDES Permit AS0000019)
COS Samoa Packing (NPDES Permit AS0000027)
Re: Effluent Bioassay Reports (June 1998 and November 1998 Sampling Episodes)
StarKist Samoa (NPDES Permit AS0000019)
COS Samoa Packing (NPDES Permit AS0000027)

Dear Carl and Sheila:

Enclosed are two copies each of the June and November 1998 sampling reports for the effluent chemistry for each of the canneries. Also enclosed are the June and November 1998 effluent bioassay reports for the combined effluent from the canneries. These reports represent the 11th and 12th semi-annual testing episodes for each of the canneries. The results are similar to the testing over the previous six years.

Sincerely,

(originals signed by)
Steven L. Costa, Ph.D.

enclosure 1: Chemical Analysis of Effluent: - June 1998 Sampling - StarKist Samoa
enclosure 2: Chemical Analysis of Effluent: - June 1998 Sampling – COS Samoa Packing
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David Wilson/CH2M Hill/SEA (w/ all enclosures)
Mike Mowatt/CH2M Hill/SFO (w/o enclosures)

PLEASE NOTE CHANGE OF ADDRESS
P.O. BOX 1238 • TRINDAD, CA • 95570
PHONE: 707-677-0123 • FAX: 707-677-9210
EMAIL: GDC@TIDEPOOL.COM

TECHNICAL MEMORANDUM

PREPARED FOR: StarKist Samoa, Inc. (NPDES Permit AS0000019)

PREPARED BY: Steve Costa and Karen Glatzel /gdc
David Wilson/CH2M HILL/SEA

DATE: 20 December 1998

SUBJECT: **Chemical Analysis of Effluent: June 1998 Sampling**

PROJECT: 147323.JC.EM

Purpose

This memorandum presents the results of the chemical analyses of StarKist Samoa effluent samples that were collected in June 1998. This was the eleventh sampling and analysis episode conducted under the current NPDES permit.

Study Objectives

Section D.2 of StarKist Samoa's NPDES permit (AS0000019) requires that semiannual priority pollutant analyses be conducted on the cannery effluent. Each effluent sampling event must coincide with effluent sampling for acute biomonitoring. Effluent samples are collected as composite samples as described below. The purpose of these analyses is to identify the chemicals present in the effluent, and provide data to determine whether the wastewater discharge complies with water quality standards.

Effluent priority pollutant analyses include those chemical constituents listed in 40 CFR 401.15. As documented in the Technical Memorandum describing the results of the March 1995 sampling (CH2M HILL, 20 June 1995) the U.S. Environmental Protection Agency Region 9 has allowed StarKist Samoa to exclude a number of previously measured constituents in the priority pollutant list. The constituents currently included in the effluent chemistry analyses are listed in Table 1.

Methods

Between 1200 on 25 June and 0900 on 26 June 1998, a 24-hour, flow-weighted composite sample of final effluent was collected from the StarKist Samoa treatment plant discharge. Effluent composite samples were collected simultaneously for chemistry and bioassay analyses. Table 1 lists the chemical analyses, detection limits, sample holding times, sample containers, and sample preservations for the effluent sample collected for chemical analysis. The standard operating procedures (SOP) for the joint cannery outfall chemistry sampling is provided in the Technical Memorandum describing the bioassay tests conducted with the March 1995 effluent sample (CH2M HILL, 20 June 1995).

Samples were collected from the established effluent sampling site following the established composite sample collection schedule for the priority pollutant analyses. A total of eight individual grab samples were collected into pre-cleaned glass containers at approximately three-hour intervals over a 24 hour period. The samples were stored on ice until the completion of the 24-hour sampling period, and then a flow-weighted composite sample was prepared. The grab sample collection times and the calculated individual volumes of each grab sample used to create the composite sample, based on StarKist Samoa's flow records, are summarized in Table 2. The final composite sample was used to fill the sample containers sent to the laboratory for analyses. The pH of the samples for analysis of metals and total phenols was measured prior to shipping and was less than 2.0 SU. A duplicate sample was taken and shipped without preservative for copper analysis using co-precipitation.

Sample containers were wrapped in bubble-wrap, placed in zip-lock bags, and packed on ice for shipment to the laboratory. Sample chain of custody forms were completed, sealed into zip-lock bags, and taped inside the lid of the ice chest. Samples were shipped to the laboratory via DHL. Samples that were composited on 26 June, were received at Analytical Resources, Incorporated (ARI) on 29 June 1998.

Results

Laboratory data sets, laboratory quality control data reports, and chain-of-custody form are attached to this memorandum. The chain-of-custody form is included as Attachment I and the laboratory analytical data sheets and quality control data reports are included as Attachment II. Table 1 indicates the detection limits requested from the analytical laboratory along with those achieved during the analysis. The laboratory indicated, prior to sample analysis, that the requested detection limits could be achieved. Detection limits were achieved for all semivolatile organics and all inorganics. In order to achieve requested detection limit, copper was analyzed using method EPA 200.7, following extraction by co-precipitation.

Semivolatile organics were all at the non-detect level with the exception of phenol and 4-methylphenol. Phenol and 4-methylphenol are compared with past sample results in Table 3.

The inorganics analyses detected only two chemical parameters in the effluent from StarKist Samoa. Arsenic and zinc were detected at comparable levels with those previously reported. Table 3 summarizes the sample results for these two substances detected for the June 1998 effluent sample analysis compared to those detected during previous analyses. Cadmium, copper, selenium, and silver were not detected in the June 1998 sampling.

Effluent Chemical Analysis
June 1998 Sampling
StarKist Samoa, Inc.

Table 1
Effluent Sample Analyses and Handling Procedures
StarKist Samoa, 25 - 26 June 1998

Chemical Parameter	Analytical Method Requested	Detection Limits, µg/l		Sample Holding Time	Sample Container	Sample Preservation
		Requested	Achieved			
Semivolatile Organics	EPA 625	10-50	10-100	7 days	1 liter amber glass	4 °C
Phenols	EPA 420.1	10	40	28 days	500 ml plastic	4 °C 5 ml H_2SO_4 [1]
Inorganics [2]						
Arsenic	EPA 206.2	5	5	6 months	500 ml plastic	4 °C, 5 ml 2N HNO_3 [1]
Cadmium	EPA 200.7	5	4	"	"	"
Chromium	EPA 200.7	10	10	"	"	"
Copper	EPA 220.2	2	4[3]	"	"	"
Lead	EPA 239.2	5	20	"	"	"
Mercury	EPA 245.1	0.4	0.1	"	"	"
Selenium	EPA 270.1	5	10[4]	"	"	"
Silver	EPA 272.2	2	1	"	"	"
Zinc	EPA 200.7	20	8	"	"	"

[1] Additional HNO_3 and H_2SO_4 was added to the sample as necessary to bring pH equal to or less than 2 at the time of composting the sample.
[2] All Inorganics were from one 500 ml plastic sample container, preserved with 5 ml 2N HNO_3, with pH of filled sample bottle measured at 1.65. An un-preserved duplicate sample was taken for Copper analysis using co-precipitation.
[3] Method EPA 200.7 used to achieve this detection limit following extraction by co-precipitation.
[4] Detection limit raised to 10 mg/l due to matrix interference.

Effluent Chemical Analysis
June 1998 Sampling
StarKist Samoa, Inc.

Table 2
Effluent Chemistry 24-hour Composite Sample Collection
StarKist Samoa, 25 - 26 June 1998

Grab Sample Number	Sampling Time	Sampling Date	Effluent Flow Rate (mgd)[1]	Percent of Total Flow	Volume of Sample (ml)	
					1 liter	500 ml
1	1200	06/25/98	1.26	12.3	123	62
2	1500	06/25/98	1.30	12.9	129	65
3	1800	06/25/98	1.25	12.4	124	62
4	2100	06/25/98	1.20	11.9	119	60
5	2400	06/25/98	1.32	13.1	131	66
6	0300	06/26/98	1.08	10.7	107	54
7	0600	06/26/98	1.33	13.2	132	66
8	0900	06/26/98	1.33	13.2	132	66
TOTALS			10.07	99.7	997	501

[1] Mean Effluent Flow Rate = 1.26

Table 3
Summary of StarKist Samoa Effluent Chemistry Sample Results
February 1993 - June 1998

Substance	Previous Sample Results, µg/L (ppb)										June 1998 Sample Results, µg/L (ppb)
	Feb 1993	Oct 1993 [1]	Feb 1994	Oct 1994	Mar 1995	Feb 1996	Mar 1996	Nov 1996	Mar 1997	Sep 1997	
Inorganics											
Arsenic	6.0	ND (14)	ND	9	ND [2]	ND	ND [3]	10	15	12	20
Cadmium	ND	ND	10	ND	ND	ND	ND	ND	ND	ND	ND
Copper	ND	(ND)	15	ND	6	13	ND [4]	5	4.7	4	ND
Selenium	ND	ND	ND [5]	ND [5]	ND [5]	ND [6]	ND [6]	15	ND	10	ND [7]
Silver	130	33 (39)	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	92	130 (180)	140	84	120	63	81	117	150	154	198
Semivolatile Organics											
Phenol	500	430	45	140	32	32	320	500	270	630	750
4-Methylphenol	260	530	360	290	310	130	370	490	310	240	500
Total Recoverable Phenols	NA	1300	120	15	34	72	510	440	290	140	660

ND = Not Detected NA = Not Analyzed

[1] Values in parentheses are results of reanalyzed samples (see Technical Memorandum for October 1993 sampling episode).

[2] Detection limit raised to 50 µg/l because of matrix interference.

[3] Detection limit raised to 400 µg/l because of matrix interference, with the resultant concentration <400 µg/l each time.

[4] Detection limit raised to 25 µg/l because of matrix interference, with the resultant concentration <25 µg/l.

[5] Detection limit raised to 50 µg/l because of matrix interference, with the resultant concentration <50 µg/l each time.

[6] Detection limit raised to 200 µg/l because of matrix interference, with the resultant concentration <200 µg/l.

[7] Detection limit raised to 10 µg/l because of matrix interference, with the resultant concentration <10 µg/l.

ATTACHMENT I

CHAIN-OF-CUSTODY FORMS

StarKist Samoa, Inc. Effluent Sample

25 - 26 June 1998

6.0

CH2MHILL Analytical Services
CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

LMG 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-1444 FAX (334) 271-3428
LRD 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244-4109
LKW Canviro Analytical Laboratories Inc., 50 Bathurst, Unit 12, Waterloo, Ontario, Canada N2V 2C5, (519) 747-2575 FAX (519) 747-3806
CVO 2300 NW Walnut Boulevard, Corvallis, OR 97330-3638, (541) 752 4271 FAX (541) 752 0276

COC #

Project #	147323.JC.EM
Purchase Order #	
Project Name	STAR KIST SAMOA - NPDES
Company Name	
Project Manager or Contact & Phone #	STEVE COSTA 707-826-0717
Report Copy to:	
Requested Completion Date:	
Site ID	
Sample Disposal:	Dispose ☐ Return ☐

Requested Analytical Method #: TOTAL PHENOLS (420.1 10ug/l) ; SEMI VOLATILES (625 C 10-50ug/l)

Preservative: H_2SO_4 ; NONE

Date	Time	COMP	GRAB	WATER	SOIL	AIR	CLIENT SAMPLE ID (9 CHARACTERS)	LAB QC	TOTAL # OF CONTAINERS	TOTAL PHENOLS (420.1 10ug/l)	SEMI VOLATILES (625 C 10-50ug/l)
6/26/98	12:00	X		X			SKS-PH		1	X	
6/26/98		X		X			SKS-SV		1		X

THIS AREA FOR LAB USE ONLY

Lab #	Page of
Lab PM	Custody Review
Log In	LIMS Verification
pH	Custody Seals Y N
	Ice Y N
QC Level 1 2 3 Other	
Cooler Temperature	
Alternate Description	Lab ID

Relinquished By	Empty Bottles	Date/Time	Received By (Empty Bottles)	Date/Time
Sampled By and Title (Please sign and print name)	LESINA SIVATIA	Date/Time 6/26/98	Relinquished By (Please sign and print name) LESINA SIVATIA	Date/Time 6/26/98
Received By (Please sign and print name)	Carrie McDougal Carrie McDougal	Date/Time 6/29/98 9:40	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)		Date/Time	Shipped Via UPS Fed-Ex Other ____	Shipping # DHL

Special Instructions:

Instructions and Agreement Provisions on Reverse Side

000009

5.0

CH2MHILL Analytical Services
CHAIN OF CUSTODY RECORD
AND AGREEMENT TO PERFORM SERVICES

LMG 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-1444 FAX (334) 271 3428

LRD 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244 4109

LKW Canviro Analytical Laboratories Inc, 50 Bathurst, Unit 12, Waterloo, Ontario, Canada N2V 2C5, (519) 747 2575 FAX (519) 747 3806

CVO 2300 NW Walnut Boulevard, Corvallis, OR 97330-3638, (541) 752 4271 FAX (541) 752 0276

COC #

Project #: 147323.JC.EM

Purchase Order #:

Project Name: STAR KIST SAMOA - NPDES

Company Name:

Project Manager or Contact & Phone #: STEVE COSTA 707-826-0717

Report Copy to:

Requested Completion Date:

Site ID:

Sample Disposal: Dispose ☐ Return ☐

Requested Analytical Method #

Method	Preservative
ARSENIC (206.2/200.9 5ug/l)	HNO3
CADMIUM (200.7 @ 5ug/l)	
CHROMIUM (200.7 @ 10ug/l)	
LEAD (239.2/200.9 .5ug/l)	
MERCURY (245.1 @ 0.4 ug/l)	
SELENIUM (270.2/200.9 5ug/l)	
SILVER (272.2/200.9 1ug/l)	
ZINC (200.7 @ 20ug/l)	
COPPER (220.1 @ 2.0ug/l)	NONE

Date	Time	COMP	GRAB	WATER	SOIL	AIR	CLIENT SAMPLE ID (9 CHARACTERS)	LAB QC	TOTAL # OF CONTAINERS	ARSENIC	CADMIUM	CHROMIUM	LEAD	MERCURY	SELENIUM	SILVER	ZINC	COPPER	Alternate Description	Lab ID
6/26/98		x		x			SKS-MT		1	x	x	x	x	x	x	x	x		*	
6/26/98		x		x			SKS-UM		1									x	hold	

THIS AREA FOR LAB USE ONLY

Lab # | Page | of
Lab PM | Custody Review
Log In | LIMS Verification
pH | Custody Seals Y N | Ice Y N
QC Level 1 2 3 Other
Cooler Temperature

Relinquished By	Empty Bottles	Date/Time	Received By	Empty Bottles	Date/Time
Sampled By and Title: Lezine Shwartz (Please sign and print name)		6/26/98	Relinquished By: Lezine Shwartz (Please sign and print name)		6/26/98
Received By: Carrie Medug Carrie McDougal (Please sign and print name)		6/29/98 9am	Relinquished By (Please sign and print name)		Date/Time
Received By (Please sign and print name)		Date/Time	Shipped Via: UPS Fed-Ex Other	Shipping #: DHL	

Special Instructions:

Instructions and Agreement Provisions on Reverse Side

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ATTACHMENT II

LABORATORY DATA REPORT
Analytical Resources, Inc.

StarKist Samoa, Inc. Effluent Sample

25 - 26 June 1998

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by EPA 625/CLP

Sample No: SKS DILUTION

Lab Sample ID: W830B-DL
LIMS ID: 98-13507
Matrix: Water
Data Release Authorized:
Reported: 07/29/98

QC Report No: W830-CH2M Hill
Project: Starkist and Chicken of the Sea NP
147323.JC.EM
Date Sampled: 06/26/98
Date Received: 06/29/98

Date extracted: 07/02/98
Date analyzed: 07/27/98
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:10

CAS Number	Analyte	ug/L
108-95-2	**Phenol**	**750**
111-44-4	Bis-(2-Chloroethyl) Ether	20 U
95-57-8	2-Chlorophenol	10 U
541-73-1	1,3-Dichlorobenzene	10 U
106-46-7	1,4-Dichlorobenzene	10 U
100-51-6	Benzyl Alcohol	50 U
95-50-1	1,2-Dichlorobenzene	10 U
95-48-7	2-Methylphenol	20 U
108-60-1	2,2'-Oxybis(1-Chloropropane)	10 U
106-44-5	**4-Methylphenol**	**500**
621-64-7	N-Nitroso-Di-N-Propylamine	20 U
67-72-1	Hexachloroethane	20 U
98-95-3	Nitrobenzene	10 U
78-59-1	Isophorone	10 U
88-75-5	2-Nitrophenol	50 U
105-67-9	2,4-Dimethylphenol	30 U
65-85-0	Benzoic Acid	100 U
111-91-1	bis(2-Chloroethoxy) Methane	10 U
120-83-2	2,4-Dichlorophenol	30 U
120-82-1	1,2,4-Trichlorobenzene	10 U
91-20-3	Naphthalene	10 U
106-47-8	4-Chloroaniline	30 U
87-68-3	Hexachlorobutadiene	20 U
59-50-7	4-Chloro-3-methylphenol	20 U
91-57-6	2-Methylnaphthalene	10 U
77-47-4	Hexachlorocyclopentadiene	50 U
88-06-2	2,4,6-Trichlorophenol	50 U
95-95-4	2,4,5-Trichlorophenol	50 U
91-58-7	2-Chloronaphthalene	10 U
88-74-4	2-Nitroaniline	50 U
131-11-3	Dimethylphthalate	10 U
208-96-8	Acenaphthylene	10 U
99-09-2	3-Nitroaniline	60 U
83-32-9	Acenaphthene	10 U
51-28-5	2,4-Dinitrophenol	100 U
100-02-7	4-Nitrophenol	50 U
132-64-9	Dibenzofuran	10 U
606-20-2	2,6-Dinitrotoluene	50 U

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by EPA 625/CLP

Sample No: **SKS DILUTION**

Lab Sample ID: W830B-DL
LIMS ID: 98-13507
Matrix: Water
Data Release Authorized: *[signature]*
Reported: 07/29/98

QC Report No: W830-CH2M Hill
Project: Starkist and Chicken of the Sea NP
147323.JC.EM
Date Sampled: 06/26/98
Date Received: 06/29/98

Date extracted: 07/02/98
Date analyzed: 07/27/98
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:10

CAS Number	Analyte	ug/L
121-14-2	2,4-Dinitrotoluene	50 U
84-66-2	Diethylphthalate	10 U
7005-72-3	4-Chlorophenyl-phenylether	10 U
86-73-7	Fluorene	10 U
100-01-6	4-Nitroaniline	50 U
534-52-1	4,6-Dinitro-2-Methylphenol	100 U
86-30-6	N-Nitrosodiphenylamine	10 U
101-55-3	4-Bromophenyl-phenylether	10 U
118-74-1	Hexachlorobenzene	10 U
87-86-5	Pentachlorophenol	50 U
85-01-8	Phenanthrene	10 U
86-74-8	Carbazole	10 U
120-12-7	Anthracene	10 U
84-74-2	Di-n-Butylphthalate	10 U
206-44-0	Fluoranthene	10 U
129-00-0	Pyrene	10 U
85-68-7	Butylbenzylphthalate	10 U
91-94-1	3,3'-Dichlorobenzidine	50 U
56-55-3	Benzo(a)anthracene	10 U
117-81-7	bis(2-Ethylhexyl)phthalate	10 U
218-01-9	Chrysene	10 U
117-84-0	Di-n-Octyl phthalate	10 U
205-99-2	Benzo(b)fluoranthene	10 U
207-08-9	Benzo(k)fluoranthene	10 U
50-32-8	Benzo(a)pyrene	10 U
193-39-5	Indeno(1,2,3-cd)pyrene	10 U
53-70-3	Dibenz(a,h)anthracene	10 U
191-24-2	Benzo(g,h,i)perylene	10 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	67.2%	d5-Phenol	81.6%
2-Fluorobiphenyl	56.4%	2-Fluorophenol	68.3%
d14-p-Terphenyl	38.4%	2,4,6-Tribromophenol	88.3%
d4-1,2-Dichlorobenzene	47.6%	d4-2-Chlorophenol	68.0%

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by EPA 625/CLP

Sample No: Method Blank

Lab Sample ID: W830MB
LIMS ID: 98-13506
Matrix: Water
Data Release Authorized: [signature]
Reported: 07/29/98

QC Report No: W830-CH2M Hill
Project: Starkist and Chicken of the Sea NP
147323.JC.EM
Date Sampled: NA
Date Received: NA

Date extracted: 07/02/98
Date analyzed: 07/25/98
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:1

CAS Number	Analyte	ug/L
108-95-2	Phenol	2.0 U
111-44-4	Bis-(2-Chloroethyl) Ether	2.0 U
95-57-8	2-Chlorophenol	1.0 U
541-73-1	1,3-Dichlorobenzene	1.0 U
106-46-7	1,4-Dichlorobenzene	1.0 U
100-51-6	Benzyl Alcohol	5.0 U
95-50-1	1,2-Dichlorobenzene	1.0 U
95-48-7	2-Methylphenol	2.0 U
108-60-1	2,2'-Oxybis(1-Chloropropane)	1.0 U
106-44-5	4-Methylphenol	1.0 U
621-64-7	N-Nitroso-Di-N-Propylamine	2.0 U
67-72-1	Hexachloroethane	2.0 U
98-95-3	Nitrobenzene	1.0 U
78-59-1	Isophorone	1.0 U
88-75-5	2-Nitrophenol	5.0 U
105-67-9	2,4-Dimethylphenol	3.0 U
65-85-0	Benzoic Acid	10 U
111-91-1	bis(2-Chloroethoxy) Methane	1.0 U
120-83-2	2,4-Dichlorophenol	3.0 U
120-82-1	1,2,4-Trichlorobenzene	1.0 U
91-20-3	Naphthalene	1.0 U
106-47-8	4-Chloroaniline	3.0 U
87-68-3	Hexachlorobutadiene	2.0 U
59-50-7	4-Chloro-3-methylphenol	2.0 U
91-57-6	2-Methylnaphthalene	1.0 U
77-47-4	Hexachlorocyclopentadiene	5.0 U
88-06-2	2,4,6-Trichlorophenol	5.0 U
95-95-4	2,4,5-Trichlorophenol	5.0 U
91-58-7	2-Chloronaphthalene	1.0 U
88-74-4	2-Nitroaniline	5.0 U
131-11-3	Dimethylphthalate	1.0 U
208-96-8	Acenaphthylene	1.0 U
99-09-2	3-Nitroaniline	6.0 U
83-32-9	Acenaphthene	1.0 U
51-28-5	2,4-Dinitrophenol	10 U
100-02-7	4-Nitrophenol	5.0 U
132-64-9	Dibenzofuran	1.0 U
606-20-2	2,6-Dinitrotoluene	5.0 U

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by EPA 625/CLP

Sample No: Method Blank

Lab Sample ID: W830MB
LIMS ID: 98-13506
Matrix: Water
Data Release Authorized: MB
Reported: 07/29/98

QC Report No: W830-CH2M Hill
Project: Starkist and Chicken of the Sea NP
147323.JC.EM
Date Sampled: NA
Date Received: NA

Date extracted: 07/02/98
Date analyzed: 07/25/98
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:1

CAS Number	Analyte	ug/L
121-14-2	2,4-Dinitrotoluene	5.0 U
84-66-2	Diethylphthalate	1.0 U
7005-72-3	4-Chlorophenyl-phenylether	1.0 U
86-73-7	Fluorene	1.0 U
100-01-6	4-Nitroaniline	5.0 U
534-52-1	4,6-Dinitro-2-Methylphenol	10 U
86-30-6	N-Nitrosodiphenylamine	1.0 U
101-55-3	4-Bromophenyl-phenylether	1.0 U
118-74-1	Hexachlorobenzene	1.0 U
87-86-5	Pentachlorophenol	5.0 U
85-01-8	Phenanthrene	1.0 U
86-74-8	Carbazole	1.0 U
120-12-7	Anthracene	1.0 U
84-74-2	Di-n-Butylphthalate	1.0 U
206-44-0	Fluoranthene	1.0 U
129-00-0	Pyrene	1.0 U
85-68-7	Butylbenzylphthalate	1.0 U
91-94-1	3,3'-Dichlorobenzidine	5.0 U
56-55-3	Benzo(a)anthracene	1.0 U
117-81-7	bis(2-Ethylhexyl)phthalate	1.0 U
218-01-9	Chrysene	1.0 U
117-84-0	Di-n-Octyl phthalate	1.0 U
205-99-2	Benzo(b)fluoranthene	1.0 U
207-08-9	Benzo(k)fluoranthene	1.0 U
50-32-8	Benzo(a)pyrene	1.0 U
193-39-5	Indeno(1,2,3-cd)pyrene	1.0 U
53-70-3	Dibenz(a,h)anthracene	1.0 U
191-24-2	Benzo(g,h,i)perylene	1.0 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	80.7%	d5-Phenol	68.1%
2-Fluorobiphenyl	73.5%	2-Fluorophenol	70.8%
d14-p-Terphenyl	129%	2,4,6-Tribromophenol	81.7%
d4-1,2-Dichlorobenzene	56.8%	d4-2-Chlorophenol	77.4%

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by EPA 625
Page 1 of 1

Lab Sample ID: W830LCS
LIMS ID: 98-13506
Matrix: Water

QC Report No: W830-CH2M Hill
Project: Starkist and Chicken of the Sea NP
147323.JC.EM

Data Release Authorized: ØU45
Reported: 07/29/98

LCS/LCS DUPLICATE RECOVERY
Date extracted: 07/02/98
Date analyzed: 07/27/98

	SPIKE VALUE	SPIKE ADDED	% RECOVERY	RPD
Phenol	26.2	37.5	69.9%	
2-Chlorophenol	29.4	37.5	78.4%	
1,4-Dichlorobenzene	14.6	25.0	58.4%	
N-Nitroso-Di-N-Propylamine	11.6	25.0	46.4%	
1,2,4-Trichlorobenzene	16.4	25.0	65.6%	
4-Chloro-3-methylphenol	29.2	37.5	77.9%	
Acenaphthene	21.6	25.0	86.4%	
4-Nitrophenol	35.6	37.5	94.9%	
2,4-Dinitrotoluene	20.8	25.0	83.2%	
Pentachlorophenol	34.5	37.5	92.0%	
Pyrene	28.5	25.0	114%	
LCS DUPLICATE				
Phenol	24.3	37.5	64.8%	7.5%
2-Chlorophenol	25.9	37.5	69.1%	13.0%
1,4-Dichlorobenzene	11.6	25.0	46.4%	23.0%
N-Nitroso-Di-N-Propylamine	9.1	25.0	36.4%	24.0%
1,2,4-Trichlorobenzene	12.5	25.0	50.0%	27.0%
4-Chloro-3-methylphenol	24.2	37.5	64.5%	19.0%
Acenaphthene	16.2	25.0	64.8%	29.0%
4-Nitrophenol	31.0	37.5	82.7%	14.0%
2,4-Dinitrotoluene	17.2	25.0	68.8%	19.0%
Pentachlorophenol	28.6	37.5	76.3%	19.0%
Pyrene	17.9	25.0	71.6%	46.0%

Lab Control Surrogate Recoveries

d5-Nitrobenzene	76.1%	d5-Phenol	66.1%
2-Fluorobiphenyl	68.8%	2-Fluorophenol	65.6%
d14-p-Terphenyl	117%	2,4,6-Tribromophenol	83.9%
d4-1,2-Dichlorobenzene	53.5%	d4-2-Chlorophenol	75.0%

LCSDuplicate Surrogate Recoveries

d5-Nitrobenzene	62.9%	d5-Phenol	62.0%
2-Fluorobiphenyl	53.8%	2-Fluorophenol	59.8%
d14-p-Terphenyl	69.2%	2,4,6-Tribromophenol	62.3%
d4-1,2-Dichlorobenzene	44.7%	d4-2-Chlorophenol	65.7%

Reported in Total ug/L

WATER SEMIVOLATILE SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: W830-CH2M Hill
Project: Starkist and Chicken of the Sea NP
147323.JC.EM

Client ID	NBZ	FBP	TPH	PHL	2FP	TBP	2CP	DCB	TOT OUT
Method Blank	80.7%	73.5%	129%	68.1%	70.8%	81.7%	77.4%	56.8%	0
Lab Control	76.1%	68.8%	117%	66.1%	65.6%	83.9%	75.0%	53.5%	0
Lab Control-DP	62.9%	53.8%	69.2%	62.0%	59.8%	62.3%	65.7%	44.7%	0
COS	95.8%	76.8%	120%	77.6%	75.2%	94.4%	87.2%	70.0%	0
COS-DL	71.6%	61.2%	74.0%	67.2%	66.9%	85.1%	68.8%	59.2%	0
SKS	86.0%	62.1%	38.0%	68.7%	83.8%	95.8%	46.5%*	59.8%	1
SKS-DL	67.2%	56.4%	38.4%	81.6%	68.3%	88.3%	68.0%	47.6%	0

LIQUID-LIQUID SW3520B		LCS/MB LIMITS	QC LIMITS
(NBZ)	= Nitrobenzene-d5	(49-109)	(43-110)
(FBP)	= 2-Fluorobiphenyl	(46-100)	(45-103)
(TPH)	= p-Terphenyl-d14	(50-134)	(29-145)
(PHL)	= Phenol-d5	(26-119)	(32-116)
(2FP)	= 2-Fluorophenol	(42-109)	(38-106)
(TBP)	= 2,4,6-Tribromophenol	(44-120)	(45-129)
(2CP)	= 2-Chlorophenol-d4	(54-108)	(48-108)
(DCB)	= 1,2-Dichlorobenzene-d4	(36-100)	(35-100)

\# Column to be used to flag recovery values

* Values outside of required QC limits

D Surrogate Compound diluted out

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample No: **SKS-MT**

Lab Sample ID: W829B
LIMS ID: 98-13503
Matrix: Water

QC Report No: W829-CH2M Hill
Project: Starkist and Chicken of the Sea
147323.JC.EM
Date Sampled: 06/26/98
Date Received: 06/29/98

Data Release Authorized:
Reported: 07/29/98

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
206.2	07/08/98	206.2	07/16/98	**7440-38-2**	**Arsenic**	0.005	**0.020**
200.7	07/08/98	200.7	07/14/98	7440-43-9	Cadmium	0.004	0.004 U
200.7	07/08/98	200.7	07/14/98	7440-47-3	Chromium	0.01	0.01 U
200.7	07/08/98	200.7	07/14/98	7440-50-8	Copper	0.004	0.004 U
239.2	07/08/98	239.2	07/16/98	7439-92-1	Lead	0.02	0.02 U
245.1	07/08/98	245.1	07/09/98	7439-97-6	Mercury	0.0001	0.0001 U
270.2	07/08/98	270.2	07/16/98	7782-49-2	Selenium	0.01	0.01 U
272.2	07/08/98	272.2	07/24/98	7440-22-4	Silver	0.001	0.001 U
200.7	07/08/98	200.7	07/14/98	**7440-66-6**	**Zinc**	0.008	**0.198**

U Analyte undetected at given RL

RL Reporting Limit

FORM-I

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample No: SKS-MT
QC Report No: W829-CH2M Hill
Project: Starkist and Chicken of the Sea
147323.JC.EM
Date Received: 06/29/98

Lab Sample ID: W829B
LIMS ID: 98-13503
Matrix: Water

Data Release Authorized:
Reported: 07/29/98

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	Sample mg/L	Duplicate mg/L	RPD	Control Limit	Q
Arsenic	0.020	0.020	0.0%	+/- 0.005	L
Cadmium	0.004 U	0.004 U	0.0%	+/- 0.004	L
Chromium	0.01 U	0.01 U	0.0%	+/- 0.01	L
Copper	0.004 U	0.004 U	0.0%	+/- 0.004	L
Lead	0.02 U	0.02 U	0.0%	+/- 0.02	L
Mercury	0.0001 U	0.0001 U	0.0%	+/- 0.0001	L
Selenium	0.01 U	0.01 U	0.0%	+/- 0.01	L
Silver	0.0010 U	0.0010 U	0.0%	+/- 0.0010	L
Zinc	0.198	0.203	2.5%	+/- 20 %	

'Q' codes:
* = control limit not met
L = RPD not valid, alternate limit = detection limit

FORM-VI

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample No: **Method Blank**

Lab Sample ID: W829MB
LIMS ID: 98-13502
Matrix: Water

QC Report No: W829-CH2M Hill
Project: Starkist and Chicken of the Sea
147323.JC.EM
Date Sampled: NA
Date Received: NA

Data Release Authorized:
Reported: 07/29/98

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
206.2	07/08/98	206.2	07/16/98	7440-38-2	Arsenic	0.001	0.001 U
200.7	07/08/98	200.7	07/14/98	7440-43-9	Cadmium	0.002	0.002 U
200.7	07/08/98	200.7	07/14/98	7440-47-3	Chromium	0.005	0.005 U
200.7	07/08/98	200.7	07/14/98	7440-50-8	Copper	0.002	0.002 U
239.2	07/08/98	239.2	07/16/98	7439-92-1	Lead	0.001	0.001 U
245.1	07/08/98	245.1	07/09/98	7439-97-6	Mercury	0.0001	0.0001 U
270.2	07/08/98	270.2	07/16/98	7782-49-2	Selenium	0.001	0.001 U
272.2	07/08/98	272.2	07/24/98	7440-22-4	Silver	0.0002	0.0002 U
200.7	07/08/98	200.7	07/14/98	7440-66-6	Zinc	0.004	0.004 U

U Analyte undetected at given RL

RL Reporting Limit

FORM-I

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No: STD REFERENCE**
I.V. Lots 1022-1 and 1037-11

Lab Sample ID: W829LCS
LIMS ID: 98-13502
Matrix: Water

QC Report No: W829-CH2M Hill
Project: Starkist and Chicken of the Sea
147323.JC.EM
Date Sampled: NA
Date Received: NA

Data Release Authorized
Reported: 07/29/98

Analyte	**STD Value**	**Value Found**	**Recovery**
Arsenic	0.100	0.098	98.0%
Cadmium	1.00	1.02	102%
Chromium	1.00	0.991	99.1%
Copper	1.00	0.965	96.5%
Lead	0.100	0.092	92.0%
Selenium	0.100	0.092	92.0%
Silver	0.020	0.018	90.0%
Zinc	1.00	1.02	102%

Recovery Limits 80-120

Values reported in parts per million (mg/L)

I.V. Lot 1037-11 used for GFA. I.V. Lot 1022-1 used for ICP.

FORM-III-R

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Lab Sample ID: W829LCS
LIMS ID: 98-13502
Matrix: Water

QC Report No: W829-CH2M Hill
Project: Starkist and Chicken of the Sea
147323.JC.EM

Data Release Authorized:
Reported: 07/29/98

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Spike mg/L	Spike Added	% Recovery	Q
Mercury	0.0019	0.0020	95.0%	

'Q' codes: N = control limit not met

Control Limits: 80-120%

FORM-VII

ANALYTICAL
RESOURCES
INCORPORATED

Final Report
Laboratory Analysis of Conventional Parameters

Sample No: SKS

Lab Sample ID: W830B
LIMS ID: 98-13507
Matrix: Water

QC Report No: W830-CH2M Hill
Project: Starkist and Chicken of the Sea NP
147323.JC.EM
Date Sampled: 06/26/98
Date Received: 06/29/98

Data Release Authorized: MAP
Reported: 07/24/98 Dr. M.A. Perkins

Analyte	Analysis Date & Batch	Method	RL	Units	Result
Phenol	07/02/98 070298#1	EPA 420.1	0.04	mg/L	0.66

RL Analytical reporting limit
U Undetected at reported detection limit

Report for W830 received 06/29/98

ANALYTICAL RESOURCES INCORPORATED

QA Report - Method Blank Analysis

QC Report No: W830-CH2M Hill
Matrix: Water
Project: Starkist and Chicken of the Sea NP
147323.JC.EM
Date Received: NA
Data Release Authorized: MP
Reported: 07/24/98 Dr. M.A. Perkins

METHOD BLANK RESULTS
CONVENTIONALS

Analysis Date & Batch	Constituent	Units	Result	
07/02/98 070298#1	Phenol	mg/L	< 0.04	U

ANALYTICAL
RESOURCES
INCORPORATED

QA Report - Laboratory Control Samples

QC Report No: W830-CH2M Hill
Project: Starkist and Chicken of the Sea NP
147323.JC.EM
Date Received: NA

Data Release Authorized: MP
Reported: 07/24/98 Dr. M.X. Perkins

LABORATORY CONTROL SAMPLES
CONVENTIONALS

Constituent	Units	Measured Value	True Value	Recovery
Laboratory Control Sample				
Phenol	mg/L	0.08	0.12	66.7%
Date analyzed: 07/02/98	Batch ID: 070298#1			
Laboratory Control Sample				
Phenol	mg/L	0.09	0.12	75.0%
Date analyzed: 07/02/98	Batch ID: 070298#1			

ANALYTICAL
RESOURCES
INCORPORATED

QA Report - Replicate Analysis

QC Report No: W830-CH2M Hill
Matrix: Water
Project: Starkist and Chicken of the Sea NP
147323.JC.EM
Date Received: 06/29/98
Data Release Authorized: MAP
Reported: 07/24/98 Dr. M.A. Perkins

DUPLICATE ANALYSIS RESULTS
CONVENTIONALS

Constituent	Units	Sample Value	Duplicate Value	RPD
ARI ID: 98-13507, W830 B	**Client Sample ID: SKS**			
Phenol	mg/L	0.66	0.64	3.1%

ANALYTICAL
RESOURCES
INCORPORATED

QA Report - Matrix Spike/Matrix Spike Duplicate Analysis

Matrix: Water

QC Report No: W830-CH2M Hill
Project: Starkist and Chicken of the Sea NP
147323.JC.EM
Date Received: 06/29/98

Data Release Authorized: MP
Reported: 07/24/98 Dr. M.A. Perkins

MATRIX SPIKE QA/QC REPORT
CONVENTIONALS

Constituent	Units	Sample Value	Spike Value	Spike Added	Recovery
ARI ID: 98-13506, W830 A Client Sample ID: COS					
Phenol	mg/L	0.07	0.44	0.40	92.5%

MS/MSD Recovery Limits: 75 - 125 %

TECHNICAL MEMORANDUM

PREPARED FOR:	Chicken of the Sea (COS) Samoa Packing Company, Inc. (NPDES Permit AS0000027)
PREPARED BY:	Steve Costa and Karen Glatzel/gdc David Wilson/CH2M HILL/SEA
DATE:	20 December 1998
SUBJECT:	**Chemical Analysis of Effluent: June 1998 Sampling**
PROJECT:	147323.JC.EM

Purpose

This memorandum presents the results of the chemical analyses of COS Samoa Packing effluent samples that were collected in June 1998. This was the eleventh sampling and analysis episode conducted under the current NPDES permit.

Study Objectives

Section D.2 of COS Samoa Packing's NPDES permit (AS0000027) requires that semiannual priority pollutant analyses be conducted on the cannery effluent. Each effluent sampling event must coincide with effluent sampling for acute biomonitoring. Effluent samples are collected as composite samples as described below. The purpose of these analyses is to identify the chemicals present in the effluent, and provide data to determine whether the wastewater discharge complies with water quality standards.

Effluent priority pollutant analyses include those chemical constituents listed in 40 CFR 401.15. As documented in the Technical Memorandum describing the results of the March 1995 sampling (CH2M HILL, 20 June 1995) the U.S. Environmental Protection Agency Region 9 has allowed COS Samoa Packing to exclude a number of previously measured constituents in the priority pollutant list. The constituents currently included in the effluent chemistry analyses are listed in Table 1.

Methods

Between 1200 on 25 June and 0900 on 26 June 1998, a 24-hour, flow-weighted composite sample of final effluent was collected from the COS Samoa Packing treatment plant discharge. Effluent composite samples were collected simultaneously for chemistry and bioassay analyses. Table 1 lists the chemical analyses, detection limits, sample holding times, sample containers, and sample preservations for the effluent sample collected for chemical analysis. The standard operating procedures (SOP) for the joint cannery outfall chemistry sampling is provided in the Technical Memorandum describing the bioassay tests conducted with the March 1995 effluent sample (CH2M HILL, 20 June 1995).

Samples were collected from the established effluent sampling site following the established composite sample collection schedule for the priority pollutant analyses. A total of eight individual grab samples were collected into pre-cleaned glass containers at approximately three-hour intervals over a 24 hour period. The samples were stored on ice until the completion of the 24-hour sampling period, and then a flow-weighted composite sample was prepared. The grab sample collection times and the calculated individual volumes of each grab sample used to create the composite sample, based on COS Samoa Packing's flow records, are summarized in Table 2. The final composite sample was used to fill the sample containers sent to the laboratory for analyses. The pH of the samples for analysis of metals and total phenol was measured prior to shipping and was less than 2.0 SU. A duplicate sample was taken and shipped without preservative for copper analysis using co-precipitation.

Sample containers were wrapped in bubble-wrap, placed in zip-lock bags, and packed on ice for shipment to the laboratory. Sample chain of custody forms were completed, sealed into zip-lock bags, and taped inside the lid of the ice chest. Samples were shipped to the laboratory via DHL. Samples that were composited on 26 June, were received at Analytical Resources, Incorporated (ARI) on 29 June 1998.

Results

Laboratory data sets, laboratory quality control data reports, and chain-of-custody form are attached to this memorandum. The chain-of-custody form is included as Attachment I and the laboratory analytical data sheets and quality control data reports are included as Attachment II. Table 1 indicates the detection limits requested from the analytical laboratory along with those achieved during the analysis. The laboratory indicated, prior to sample analysis, that the requested detection limits could be achieved. In order to achieve requested detection limit, copper was analyzed using method EPA 200.7, following extraction by co-precipitation.

Semivolatile organics were all at the non-detect level with the exception of phenol and 4-methylphenol. Phenol and 4-methylphenol are compared with past sample results in Table 3. Total recoverable phenols were detected at 70 µg/l.

Table 3 summarizes the sample results for substances detected for the June 1998 effluent sample analysis compared to those detected during previous analyses. The analyses detected five chemical parameters in the effluent from COS Samoa Packing. Arsenic, copper, selenium, and zinc were detected at comparable levels with those previously reported. Lead was detected at 2 µg/l near the reported limit of detection (1 µg/l).

Table 1 Effluent Sample Analyses and Handling Procedures COS Samoa Packing, 25 - 26 June 1998						
Chemical Parameter	**Analytical Method Requested**	**Detection Limits, µg/l**		**Sample Holding Time**	**Sample Container**	**Sample Preservation**
		Requested	**Achieved**			
Semivolatile Organics	EPA 625	10-50	10-100	7 days	1 liter amber glass	4 °C
Phenols	EPA 420.1	10	40	28 days	500 ml plastic	4 °C, 5 ml H_2SO_4[1]
Inorganics [2]						
Arsenic	EPA 206.2	5	5	6 months	500 ml plastic	4 °C, 5 ml 2N HNO_3[1]
Cadmium	EPA 200.7	5	2	"	"	"
Chromium	EPA 200.7	10	5	"	"	"
Copper	EPA 220.2	2	2[3]	"	"	"
Lead	EPA 239.2	5	1	"	"	"
Mercury	EPA 245.1	0.4	0.1	"	"	"
Selenium	EPA 270.1	5	5[4]	"	"	"
Silver	EPA 272.2	2	0.2	"	"	"
Zinc	EPA 200.7	20	4	"	"	"

[1] Additional HNO_3 and H_2SO_4 was added to the sample as necessary to bring pH equal to or less than 2 at the time of composting the sample.
[2] All Inorganics were from one 500 ml plastic sample container, preserved with 5 ml 2N HNO_3, with pH of filled sample bottle measured at 1.65. An un-preserved duplicate sample was taken for Copper analysis using co-precipitation.
[3] Method EPA 200.7 used to achieve this detection limit following extraction by co-precipitation.
[4] Method EPA 270.2 used to achieve this detection limit.

Table 2
Effluent Chemistry 24-hour Composite Sample Collection
COS Samoa Packing, 25 - 26 June 1998

Grab Sample Number	Sampling Time	Sampling Date	Effluent Flow Rate (mgd)[1]	Percent of Total Flow	Volume of Sample (ml)	
					1 liter	500 ml
1	1200	06/25/98	0.96	12.4	124	62
2	1500	06/25/98	0.82	10.6	106	63
3	1800	06/25/98	0.98	13.7	137	68
4	2100	06/25/98	1.04	13.4	134	67
5	2400	06/25/98	1.04	13.4	134	67
6	0300	06/26/98	1.00	12.9	129	64
7	0600	06/26/98	0.96	12.4	124	62
8	0900	06/26/98	0.88	13.3	113	57
TOTALS			7.68	100	1000	500

[1] Mean effluent flow rate 0.96mgd.

Effluent Chemical Analysis
June 1998 Sampling
COS Samoa Packing

Table 3
Summary of COS Samoa Packing Effluent Chemistry Sample Results
February 1993 - June 1998

Substance	Previous Sample Results, µg/L (ppb)										June 1998 Sample Results, µg/L (ppb)
	Feb 1993	Oct 1993 [1]	Feb 1994	Oct 1994	Mar 1995	Feb 1996	Mar 1996	Nov 1996	Mar 1997	Sep 1997	1998
Inorganics											
Arsenic	9.8	ND (15)	25	25	32	14	ND [2]	16	24	24	21
Copper	21	(ND) (ND)	13	23	9	54	ND [3]	11	11	12	24
Lead	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
Selenium	4.3	ND (2.5)	ND	ND	ND	5.4	ND	ND	2	ND	12
Silver	ND	ND	22	16	33	<50 [4]	ND [5]	ND	ND	ND	ND
Zinc	380	400 (540)	660	760	570	440	740	471	484	585	657
Semivolatile Organics											
Benzoic Acid	120	ND	ND	ND	ND	ND	ND	ND	ND	53[6]	ND
Phenol	110	ND	69	120	32	110	89	150	73	52	51
4-Methylphenol	670	1600	770	2800	2400	1600	6800	1800	860	1600	420
Total Recoverable Phenols	NA	570	84	280	150	170	170	140	80	70	70

ND = Not Detected NA = Not Analyzed
[1] Values in parentheses are results of reanalyzed samples (see Technical Memorandum for October 1993 sampling episode).
[2] Detection limit raised to 400 µg/l because of matrix interference, with the resultant concentration <400 µg/l each time.
[3] Detection limit raised to 25 µg/l because of matrix interference, with the resultant concentration <25 µg/l.
[4] Detection limit raised to 50 µg/l because of matrix interference, with the resultant concentration <50 µg/l each time.
[5] Detection limit raised to 200 µg/l because of matrix interference, with the resultant concentration <200 µg/l.
[6] Detected at dilution 1:3, ND at dilution 1:40.

ATTACHMENT I

CHAIN-OF-CUSTODY FORMS

COS Samoa Packing Company, Inc. Effluent Sample

25 - 26 June 1998

CH2MHILL Analytical Services
CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

LMG 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-1444 FAX (334) 271-3428
LRD 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244-4109
LKW Canviro Analytical Laboratories, Inc., 50 Bathurst, Unit 12, Waterloo, Ontario, Canada N2V 2C5, (519) 747-2575 FAX (519) 747-3806
CVO 2300 NW Walnut Boulevard, Corvallis, OR 97330-3638, (541) 752-4271 FAX (541) 752-0276

COC # ______

Project #
Purchase Order #
Project Name: COS-SAMOA PACKING- NPDES
Company Name
Project Manager or Contact & Phone #: STEVE COSTA 707-826-0717
Report Copy to: SAME
Requested Completion Date:
Site ID
Sample Disposal: Dispose ☐ Return ☐

Requested Analytical Method # / **Preservative**

Date	Time	COMP	GRAB	WATER	SOIL	AIR	CLIENT SAMPLE ID (9 CHARACTERS)	LAB QC	TOTAL # OF CONTAINERS	TOTAL PHENOLS (H_2SO_4)	SEMI-VOLATILES (NONE)	INORGANICS / METALS (PRESERVED) (HNO_3)	INORGANICS / METALS (UNPRESERVED) (NONE)
6/25/98	24 HRS	X		X			COS-PH		1	X			
6/25/98	24 HRS	X		X			COS-SV		1		X		
6/25/98	24 HRS	X		X			COS-MT		1			X	
6/25/98	24 HRS	X		X			COS-UM		1				X

THIS AREA FOR LAB USE ONLY

Lab #	Page of
Lab PM	Custody Review
Log In	LIMS Verification
pH	Custody Seals Y N
	Ice Y N
QC Level 1 2 3 Other	
Cooler Temperature	
Alternate Description	Lab ID
★ nord	
98-13504 to 98-13507 W830	

000005

Relinquished By	Empty Bottles	Date/Time	Received By / Empty Bottles	Date/Time
Sampled By and Title (Please sign and print name): MALO / UTILITIES - LEAD PERSON		Date/Time: 6/25/98	Relinquished By (Please sign and print name): FELICITA PEPITO	Date/Time: 6/26/98
Received By (Please sign and print name): Carrie McDougal		Date/Time: 6/26/98 9AM	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)		Date/Time	Shipped Via: UPS Fed-Ex Other ______	Shipping #

Special Instructions:

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB Yellow - LAB Pink - Client

ATTACHMENT II

LABORATORY DATA REPORT
Analytical Resources, Inc.

COS Samoa Packing Company, Inc. Effluent Sample

25 - 26 June 1998

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by EPA 625/CLP

Sample No: COS DILUTION

Lab Sample ID: W830A-DL
LIMS ID: 98-13506
Matrix: Water
Data Release Authorized: [signature]
Reported: 07/29/98

QC Report No: W830-CH2M Hill
Project: Starkist and Chicken of the Sea NP 147323.JC.EM
Date Sampled: 06/25/98
Date Received: 06/29/98

Date extracted: 07/02/98
Date analyzed: 07/27/98
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:10

CAS Number	Analyte	ug/L
108-95-2	**Phenol**	**51**
111-44-4	Bis-(2-Chloroethyl) Ether	20 U
95-57-8	2-Chlorophenol	10 U
541-73-1	1,3-Dichlorobenzene	10 U
106-46-7	1,4-Dichlorobenzene	10 U
100-51-6	Benzyl Alcohol	50 U
95-50-1	1,2-Dichlorobenzene	10 U
95-48-7	2-Methylphenol	20 U
108-60-1	2,2'-Oxybis(1-Chloropropane)	10 U
106-44-5	**4-Methylphenol**	**420**
621-64-7	N-Nitroso-Di-N-Propylamine	20 U
67-72-1	Hexachloroethane	20 U
98-95-3	Nitrobenzene	10 U
78-59-1	Isophorone	10 U
88-75-5	2-Nitrophenol	50 U
105-67-9	2,4-Dimethylphenol	30 U
65-85-0	Benzoic Acid	100 U
111-91-1	bis(2-Chloroethoxy) Methane	10 U
120-83-2	2,4-Dichlorophenol	30 U
120-82-1	1,2,4-Trichlorobenzene	10 U
91-20-3	Naphthalene	10 U
106-47-8	4-Chloroaniline	30 U
87-68-3	Hexachlorobutadiene	20 U
59-50-7	4-Chloro-3-methylphenol	20 U
91-57-6	2-Methylnaphthalene	10 U
77-47-4	Hexachlorocyclopentadiene	50 U
88-06-2	2,4,6-Trichlorophenol	50 U
95-95-4	2,4,5-Trichlorophenol	50 U
91-58-7	2-Chloronaphthalene	10 U
88-74-4	2-Nitroaniline	50 U
131-11-3	Dimethylphthalate	10 U
208-96-8	Acenaphthylene	10 U
99-09-2	3-Nitroaniline	60 U
83-32-9	Acenaphthene	10 U
51-28-5	2,4-Dinitrophenol	100 U
100-02-7	4-Nitrophenol	50 U
132-64-9	Dibenzofuran	10 U
606-20-2	2,6-Dinitrotoluene	50 U

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by EPA 625/CLP

Sample No: COS
DILUTION

Lab Sample ID: W830A-DL
LIMS ID: 98-13506
Matrix: Water
Data Release Authorized: [signature]
Reported: 07/29/98

QC Report No: W830-CH2M Hill
Project: Starkist and Chicken of the Sea NP
147323.JC.EM
Date Sampled: 06/25/98
Date Received: 06/29/98

Date extracted: 07/02/98
Date analyzed: 07/27/98
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:10

CAS Number	Analyte	ug/L
121-14-2	2,4-Dinitrotoluene	50 U
84-66-2	Diethylphthalate	10 U
7005-72-3	4-Chlorophenyl-phenylether	10 U
86-73-7	Fluorene	10 U
100-01-6	4-Nitroaniline	50 U
534-52-1	4,6-Dinitro-2-Methylphenol	100 U
86-30-6	N-Nitrosodiphenylamine	10 U
101-55-3	4-Bromophenyl-phenylether	10 U
118-74-1	Hexachlorobenzene	10 U
87-86-5	Pentachlorophenol	50 U
85-01-8	Phenanthrene	10 U
86-74-8	Carbazole	10 U
120-12-7	Anthracene	10 U
84-74-2	Di-n-Butylphthalate	10 U
206-44-0	Fluoranthene	10 U
129-00-0	Pyrene	10 U
85-68-7	Butylbenzylphthalate	10 U
91-94-1	3,3'-Dichlorobenzidine	50 U
56-55-3	Benzo(a)anthracene	10 U
117-81-7	bis(2-Ethylhexyl)phthalate	10 U
218-01-9	Chrysene	10 U
117-84-0	Di-n-Octyl phthalate	10 U
205-99-2	Benzo(b)fluoranthene	10 U
207-08-9	Benzo(k)fluoranthene	10 U
50-32-8	Benzo(a)pyrene	10 U
193-39-5	Indeno(1,2,3-cd)pyrene	10 U
53-70-3	Dibenz(a,h)anthracene	10 U
191-24-2	Benzo(g,h,i)perylene	10 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	71.6%	d5-Phenol	67.2%
2-Fluorobiphenyl	61.2%	2-Fluorophenol	66.9%
d14-p-Terphenyl	74.0%	2,4,6-Tribromophenol	85.1%
d4-1,2-Dichlorobenzene	59.2%	d4-2-Chlorophenol	68.8%

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by EPA 625/CLP

Sample No: Method Blank

Lab Sample ID: W830MB
LIMS ID: 98-13506
Matrix: Water
Data Release Authorized:
Reported: 07/29/98

QC Report No: W830-CH2M Hill
Project: Starkist and Chicken of the Sea NP
147323.JC.EM
Date Sampled: NA
Date Received: NA

Date extracted: 07/02/98
Date analyzed: 07/25/98
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:1

CAS Number	Analyte	ug/L
108-95-2	Phenol	2.0 U
111-44-4	Bis-(2-Chloroethyl) Ether	2.0 U
95-57-8	2-Chlorophenol	1.0 U
541-73-1	1,3-Dichlorobenzene	1.0 U
106-46-7	1,4-Dichlorobenzene	1.0 U
100-51-6	Benzyl Alcohol	5.0 U
95-50-1	1,2-Dichlorobenzene	1.0 U
95-48-7	2-Methylphenol	2.0 U
108-60-1	2,2'-Oxybis(1-Chloropropane)	1.0 U
106-44-5	4-Methylphenol	1.0 U
621-64-7	N-Nitroso-Di-N-Propylamine	2.0 U
67-72-1	Hexachloroethane	2.0 U
98-95-3	Nitrobenzene	1.0 U
78-59-1	Isophorone	1.0 U
88-75-5	2-Nitrophenol	5.0 U
105-67-9	2,4-Dimethylphenol	3.0 U
65-85-0	Benzoic Acid	10 U
111-91-1	bis(2-Chloroethoxy) Methane	1.0 U
120-83-2	2,4-Dichlorophenol	3.0 U
120-82-1	1,2,4-Trichlorobenzene	1.0 U
91-20-3	Naphthalene	1.0 U
106-47-8	4-Chloroaniline	3.0 U
87-68-3	Hexachlorobutadiene	2.0 U
59-50-7	4-Chloro-3-methylphenol	2.0 U
91-57-6	2-Methylnaphthalene	1.0 U
77-47-4	Hexachlorocyclopentadiene	5.0 U
88-06-2	2,4,6-Trichlorophenol	5.0 U
95-95-4	2,4,5-Trichlorophenol	5.0 U
91-58-7	2-Chloronaphthalene	1.0 U
88-74-4	2-Nitroaniline	5.0 U
131-11-3	Dimethylphthalate	1.0 U
208-96-8	Acenaphthylene	1.0 U
99-09-2	3-Nitroaniline	6.0 U
83-32-9	Acenaphthene	1.0 U
51-28-5	2,4-Dinitrophenol	10 U
100-02-7	4-Nitrophenol	5.0 U
132-64-9	Dibenzofuran	1.0 U
606-20-2	2,6-Dinitrotoluene	5.0 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by EPA 625/CLP

Sample No: Method Blank

Lab Sample ID: W830MB
LIMS ID: 98-13506
Matrix: Water
Data Release Authorized: *[signature]*
Reported: 07/29/98

QC Report No: W830-CH2M Hill
Project: Starkist and Chicken of the Sea NP
147323.JC.EM
Date Sampled: NA
Date Received: NA

Date extracted: 07/02/98
Date analyzed: 07/25/98
Instrument: ntl

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:1

CAS Number	Analyte	ug/L
121-14-2	2,4-Dinitrotoluene	5.0 U
84-66-2	Diethylphthalate	1.0 U
7005-72-3	4-Chlorophenyl-phenylether	1.0 U
86-73-7	Fluorene	1.0 U
100-01-6	4-Nitroaniline	5.0 U
534-52-1	4,6-Dinitro-2-Methylphenol	10 U
86-30-6	N-Nitrosodiphenylamine	1.0 U
101-55-3	4-Bromophenyl-phenylether	1.0 U
118-74-1	Hexachlorobenzene	1.0 U
87-86-5	Pentachlorophenol	5.0 U
85-01-8	Phenanthrene	1.0 U
86-74-8	Carbazole	1.0 U
120-12-7	Anthracene	1.0 U
84-74-2	Di-n-Butylphthalate	1.0 U
206-44-0	Fluoranthene	1.0 U
129-00-0	Pyrene	1.0 U
85-68-7	Butylbenzylphthalate	1.0 U
91-94-1	3,3'-Dichlorobenzidine	5.0 U
56-55-3	Benzo(a)anthracene	1.0 U
117-81-7	bis(2-Ethylhexyl)phthalate	1.0 U
218-01-9	Chrysene	1.0 U
117-84-0	Di-n-Octyl phthalate	1.0 U
205-99-2	Benzo(b)fluoranthene	1.0 U
207-08-9	Benzo(k)fluoranthene	1.0 U
50-32-8	Benzo(a)pyrene	1.0 U
193-39-5	Indeno(1,2,3-cd)pyrene	1.0 U
53-70-3	Dibenz(a,h)anthracene	1.0 U
191-24-2	Benzo(g,h,i)perylene	1.0 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	80.7%	d5-Phenol	68.1%
2-Fluorobiphenyl	73.5%	2-Fluorophenol	70.8%
d14-p-Terphenyl	129%	2,4,6-Tribromophenol	81.7%
d4-1,2-Dichlorobenzene	56.8%	d4-2-Chlorophenol	77.4%

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by EPA 625
Page 1 of 1

Lab Sample ID: W830LCS
LIMS ID: 98-13506
Matrix: Water

QC Report No: W830-CH2M Hill
Project: Starkist and Ch:cken of the Sea NP
147323.JC.EM

Data Release Authorized: OHS
Reported: 07/29/98

LCS/LCS DUPLICATE RECOVERY
Date extracted: 07/02/98
Date analyzed: 07/27/98

	SPIKE VALUE	SPIKE ADDED	% RECOVERY	RPD
Phenol	26.2	37.5	69.9%	
2-Chlorophenol	29.4	37.5	78.4%	
1,4-Dichlorobenzene	14.6	25.0	58.4%	
N-Nitroso-Di-N-Propylamine	11.6	25.0	46.4%	
1,2,4-Trichlorobenzene	16.4	25.0	65.6%	
4-Chloro-3-methylphenol	29.2	37.5	77.9%	
Acenaphthene	21.6	25.0	86.4%	
4-Nitrophenol	35.6	37.5	94.9%	
2,4-Dinitrotoluene	20.8	25.0	83.2%	
Pentachlorophenol	34.5	37.5	92.0%	
Pyrene	28.5	25.0	114%	
LCS DUPLICATE				
Phenol	24.3	37.5	64.8%	7.5%
2-Chlorophenol	25.9	37.5	69.1%	13.0%
1,4-Dichlorobenzene	11.6	25.0	46.4%	23.0%
N-Nitroso-Di-N-Propylamine	9.1	25.0	36.4%	24.0%
1,2,4-Trichlorobenzene	12.5	25.0	50.0%	27.0%
4-Chloro-3-methylphenol	24.2	37.5	64.5%	19.0%
Acenaphthene	16.2	25.0	64.8%	29.0%
4-Nitrophenol	31.0	37.5	82.7%	14.0%
2,4-Dinitrotoluene	17.2	25.0	68.8%	19.0%
Pentachlorophenol	28.6	37.5	76.3%	19.0%
Pyrene	17.9	25.0	71.6%	46.0%

Lab Control Surrogate Recoveries

d5-Nitrobenzene	76.1%	d5-Phenol	66.1%
2-Fluorobiphenyl	68.8%	2-Fluorophenol	65.6%
d14-p-Terphenyl	117%	2,4,6-Tribromophenol	83.9%
d4-1,2-Dichlorobenzene	53.5%	d4-2-Chlorophenol	75.0%

LCSDuplicate Surrogate Recoveries

d5-Nitrobenzene	62.9%	d5-Phenol	62.0%
2-Fluorobiphenyl	53.8%	2-Fluorophenol	59.8%
d14-p-Terphenyl	69.2%	2,4,6-Tribromophenol	62.3%
d4-1,2-Dichlorobenzene	44.7%	d4-2-Chlorophenol	65.7%

Reported in Total ug/L

FORM-III

ANALYTICAL
RESOURCES
INCORPORATED

WATER SEMIVOLATILE SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: W830-CH2M Hill
Project: Starkist and Chicken of the Sea NP
147323.JC.EM

Client ID	NBZ	FBP	TPH	PHL	2FP	TBP	2CP	DCB	TOT OUT
Method Blank	80.7%	73.5%	129%	68.1%	70.8%	81.7%	77.4%	56.8%	0
Lab Control	76.1%	68.8%	117%	66.1%	65.6%	83.9%	75.0%	53.5%	0
Lab Control-DP	62.9%	53.8%	69.2%	62.0%	59.8%	62.3%	65.7%	44.7%	0
COS	95.8%	76.8%	120%	77.6%	75.2%	94.4%	87.2%	70.0%	0
COS-DL	71.6%	61.2%	74.0%	67.2%	66.9%	85.1%	68.8%	59.2%	0
SKS	86.0%	62.1%	38.0%	68.7%	83.8%	95.8%	46.5%*	59.8%	1
SKS-DL	67.2%	56.4%	38.4%	81.6%	68.3%	88.3%	68.0%	47.6%	0

LIQUID-LIQUID SW3520B

		LCS/MB LIMITS	QC LIMITS
(NBZ)	= Nitrobenzene-d5	(49-109)	(43-110)
(FBP)	= 2-Fluorobiphenyl	(46-100)	(45-103)
(TPH)	= p-Terphenyl-d14	(50-134)	(29-145)
(PHL)	= Phenol-d5	(26-119)	(32-116)
(2FP)	= 2-Fluorophenol	(42-109)	(38-106)
(TBP)	= 2,4,6-Tribromophenol	(44-120)	(45-129)
(2CP)	= 2-Chlorophenol-d4	(54-108)	(48-108)
(DCB)	= 1,2-Dichlorobenzene-d4	(36-100)	(35-100)

\# Column to be used to flag recovery values

* Values outside of required QC limits

D Surrogate Compound diluted out

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample No: COS-MT

Lab Sample ID: W829A
LIMS ID: 98-13502
Matrix: Water

QC Report No: W829-CH2M Hill
Project: Starkist and Chicken of the Sea
147323.JC.EM
Date Sampled: 06/25/98
Date Received: 06/29/98

Data Release Authorized:
Reported: 07/29/98

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
206.2	07/08/98	206.2	07/16/98	**7440-38-2**	**Arsenic**	0.005	**0.021**
200.7	07/08/98	200.7	07/14/98	7440-43-9	Cadmium	0.002	0.002 U
200.7	07/08/98	200.7	07/14/98	7440-47-3	Chromium	0.005	0.005 U
200.7	07/08/98	200.7	07/14/98	**7440-50-8**	**Copper**	0.002	**0.024**
239.2	07/08/98	239.2	07/16/98	**7439-92-1**	**Lead**	0.001	**0.002**
245.1	07/08/98	245.1	07/09/98	7439-97-6	Mercury	0.0001	0.0001 U
270.2	07/08/98	270.2	07/16/98	**7782-49-2**	**Selenium**	0.005	**0.012**
272.2	07/08/98	272.2	07/24/98	7440-22-4	Silver	0.0002	0.0002 U
200.7	07/08/98	200.7	07/14/98	**7440-66-6**	**Zinc**	0.004	**0.657**

U Analyte undetected at given RL

RL Reporting Limit

FORM-I

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample No: COS-MT
Lab Sample ID: W829A — QC Report No: W829-CH2M Hill
LIMS ID: 98-13502 — Project: Starkist and Chicken of the Sea
Matrix: Water — 147323.JC.EM
Date Received: 06/29/98

Data Release Authorized:
Reported: 07/29/98

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	Sample mg/L	Spike mg/L	Spike Added	% Recovery	Q
Arsenic	0.021	0.054	0.040	82.5%	
Cadmium	0.002 U	0.051	0.050	102%	
Chromium	0.005 U	0.185	0.200	92.5%	
Copper	0.024	0.250	0.250	90.4%	
Lead	0.002	0.019	0.020	85.0%	
Mercury	0.0001 U	0.0006	0.0010	60.0%	N
Selenium	0.012	0.020	0.010	80.0%	
Silver	0.0002 U	0.0203	0.0200	102%	
Zinc	0.657	1.12	0.500	92.6%	

'Q' codes:
N = control limit not met
H = %R not applicable, sample concentration too high
* = RPD control limit not met
NA = Not applicable - analyte not spiked

Control Limits: Percent Recovery: 75-125%
RPD: +/-20%

FORM-V

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample No: **Method Blank**

Lab Sample ID: W829MB
LIMS ID: 98-13502
Matrix: Water

QC Report No: W829-CH2M Hill
Project: Starkist and Chicken of the Sea
147323.JC.EM
Date Sampled: NA
Date Received: NA

Data Release Authorized:
Reported: 07/29/98

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
206.2	07/08/98	206.2	07/16/98	7440-38-2	Arsenic	0.001	0.001 U
200.7	07/08/98	200.7	07/14/98	7440-43-9	Cadmium	0.002	0.002 U
200.7	07/08/98	200.7	07/14/98	7440-47-3	Chromium	0.005	0.005 U
200.7	07/08/98	200.7	07/14/98	7440-50-8	Copper	0.002	0.002 U
239.2	07/08/98	239.2	07/16/98	7439-92-1	Lead	0.001	0.001 U
245.1	07/08/98	245.1	07/09/98	7439-97-6	Mercury	0.0001	0.0001 U
270.2	07/08/98	270.2	07/16/98	7782-49-2	Selenium	0.001	0.001 U
272.2	07/08/98	272.2	07/24/98	7440-22-4	Silver	0.0002	0.0002 U
200.7	07/08/98	200.7	07/14/98	7440-66-6	Zinc	0.004	0.004 U

U Analyte undetected at given RL

RL Reporting Limit

FORM-I

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET

Sample No: STD REFERENCE
I.V. Lots 1022-1 and 1037-11

Lab Sample ID: W829LCS
LIMS ID: 98-13502
Matrix: Water

QC Report No: W829-CH2M Hill
Project: Starkist and Chicken of the Sea
147323.JC.EM
Date Sampled: NA
Date Received: NA

Data Release Authorized
Reported: 07/29/98

Analyte	STD Value	Value Found	Recovery
Arsenic	0.100	0.098	98.0%
Cadmium	1.00	1.02	102%
Chromium	1.00	0.991	99.1%
Copper	1.00	0.965	96.5%
Lead	0.100	0.092	92.0%
Selenium	0.100	0.092	92.0%
Silver	0.020	0.018	90.0%
Zinc	1.00	1.02	102%

Recovery Limits 80-120

Values reported in parts per million (mg/L)

I.V. Lot 1037-11 used for GFA. I.V. Lot 1022-1 used for ICP.

FORM-III-R

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Lab Sample ID: W829LCS
LIMS ID: 98-13502
Matrix: Water

QC Report No: W829-CH2M Hill
Project: Starkist and Chicken of the Sea
147323.JC.EM

Data Release Authorized:
Reported: 07/29/98

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Spike mg/L	Spike Added	% Recovery	Q
Mercury	0.0019	0.0020	95.0%	

'Q' codes: N = control limit not met

Control Limits: 80-120%

FORM-VII

ANALYTICAL
RESOURCES
INCORPORATED

Final Report
Laboratory Analysis of Conventional Parameters

Sample No: COS

Lab Sample ID: W830A
LIMS ID: 98-13506
Matrix: Water

Data Release Authorized: MP
Reported: 07/24/98 Dr. M.A. Perkins

QC Report No: W830-CH2M Hill
Project: Starkist and Chicken of the Sea NP
147323.JC.EM
Date Sampled: 06/25/98
Date Received: 06/29/98

Analyte	Analysis Date & Batch	Method	RL	Units	Result
Phenol	07/02/98 070298#1	EPA 420.1	0.04	mg/L	0.07

RL Analytical reporting limit
U Undetected at reported detection limit

Report for W830 received 06/29/98

ANALYTICAL
RESOURCES
INCORPORATED

QA Report - Method Blank Analysis

Matrix: Water

QC Report No: W830-CH2M Hill
Project: Starkist and Chicken of the Sea NP
147323.JC.EM
Date Received: NA

Data Release Authorized: MP
Reported: 07/24/98 Dr. M.A. Perkins

METHOD BLANK RESULTS
CONVENTIONALS

Analysis Date & Batch	**Constituent**	**Units**	**Result**	
07/02/98 070298#1	Phenol	mg/L	< 0.04	U

ANALYTICAL
RESOURCES
INCORPORATED

QA Report - Laboratory Control Samples

QC Report No: W830-CH2M Hill
Project: Starkist and Chicken of the Sea NP
147323.JC.EM
Date Received: NA

Data Release Authorized:
Reported: 07/24/98 Dr. M.A. Perkins

LABORATORY CONTROL SAMPLES
CONVENTIONALS

Constituent	Units	Measured Value	True Value	Recovery
Laboratory Control Sample				
Phenol	mg/L	0.08	0.12	66.7%
Date analyzed: 07/02/98	Batch ID: 070298#1			
Laboratory Control Sample				
Phenol	mg/L	0.09	0.12	75.0%
Date analyzed: 07/02/98	Batch ID: 070298#1			

ANALYTICAL
RESOURCES
INCORPORATED

QA Report - Replicate Analysis

QC Report No: W830-CH2M Hill
Project: Starkist and Chicken of the Sea NP
147323.JC.EM
Date Received: 06/29/98

Matrix: Water

Data Release Authorized:
Reported: 07/24/98 Dr. M.A. Perkins

DUPLICATE ANALYSIS RESULTS
CONVENTIONALS

Constituent	Units	Sample Value	Duplicate Value	RPD
ARI ID: 98-13507, W830 B	**Client Sample ID: SKS**			
Phenol	mg/L	0.66	0.64	3.1%

ANALYTICAL
RESOURCES
INCORPORATED

QA Report - Matrix Spike/Matrix Spike Duplicate Analysis

Matrix: Water

QC Report No: W830-CH2M Hill
Project: Starkist and Chicken of the Sea NP
147323.JC.EM
Date Received: 06/29/98

Data Release Authorized: MAP
Reported: 07/24/98 Dr. M.A. Perkins

MATRIX SPIKE QA/QC REPORT
CONVENTIONALS

Constituent	Units	Sample Value	Spike Value	Spike Added	Recovery
ARI ID: 98-13506, W830 A Client Sample ID: COS					
Phenol	mg/L	0.07	0.44	0.40	92.5%

MS/MSD Recovery Limits: 75 - 125 %

TECHNICAL MEMORANDUM

PREPARED FOR: StarKist Samoa, Inc. (NPDES Permit AS0000019)

PREPARED BY: Steve Costa and Karen Glatzel /gdc
David Wilson/CH2M HILL/SEA

DATE: 31 December 1999

SUBJECT: **Chemical Analysis of Effluent: November 1998 Sampling**

PROJECT: 147323.JC.EM

Purpose

This memorandum presents the results of the chemical analyses of StarKist Samoa effluent samples that were collected in November 1998. This was the twelfth sampling and analysis episode conducted under the current NPDES permit.

Study Objectives

Section D.2 of StarKist Samoa's NPDES permit (AS0000019) requires that semiannual priority pollutant analyses be conducted on the cannery effluent. Each effluent sampling event must coincide with effluent sampling for acute biomonitoring. Effluent samples are collected as composite samples as described below. The purpose of these analyses is to identify the chemicals present in the effluent, and provide data to determine whether the wastewater discharge complies with water quality standards.

Effluent priority pollutant analyses include those chemical constituents listed in 40 CFR 401.15. As documented in the Technical Memorandum describing the results of the March 1995 sampling (CH2M HILL, 20 June 1995) the U.S. Environmental Protection Agency Region 9 has allowed StarKist Samoa to exclude a number of previously measured constituents in the priority pollutant list. The constituents currently included in the effluent chemistry analyses are listed in Table 1.

Methods

Between 1200 on 19 November and 0900 on 20 November 1998, a 24-hour, flow-weighted composite sample of final effluent was collected from the StarKist Samoa treatment plant discharge. Effluent composite samples were collected simultaneously for chemistry and bioassay analyses. Table 1 lists the chemical analyses, detection limits, sample holding times, sample containers, and sample preservations for the effluent sample collected for chemical analysis. The standard operating procedures (SOP) for the joint cannery outfall chemistry sampling is provided in the Technical

Memorandum describing the bioassay tests conducted with the March 1995 effluent sample (CH2M HILL, 20 June 1995).

Samples were collected from the established effluent sampling site following the established composite sample collection schedule for the priority pollutant analyses. A total of eight individual grab samples were collected into pre-cleaned glass containers at approximately three-hour intervals over a 24 hour period. The samples were stored on ice until the completion of the 24-hour sampling period, and then a flow-weighted composite sample was prepared. The grab sample collection times and the calculated individual volumes of each grab sample used to create the composite sample, based on StarKist Samoa's flow records, are summarized in Table 2. The final composite sample was used to fill the sample containers sent to the laboratory for analyses. The pH of the samples for analysis of metals and total phenols was measured prior to shipping and was less than 2.0 SU. A duplicate sample was taken and shipped without preservative for copper analysis using co-precipitation.

Sample containers were wrapped in bubble-wrap, placed in zip-lock bags, and packed on ice for shipment to the laboratory. Sample chain of custody forms were completed, sealed into zip-lock bags, and taped inside the lid of the ice chest. Samples were shipped to the laboratory via DHL. Samples that were composited on 20 November, were received at Analytical Resources, Incorporated (ARI) 23 November 1998.

Results

Laboratory data sets, laboratory quality control data reports, and chain-of-custody form are attached to this memorandum. The chain-of-custody form is included as Attachment I and the laboratory analytical data sheets and quality control data reports are included as Attachment II. Table 1 indicates the detection limits requested from the analytical laboratory along with those achieved during the analysis. The laboratory indicated, prior to sample analysis, that the requested detection limits could be achieved. Detection limits were achieved for all semivolatile organics and all inorganics. In order to achieve requested detection limit, copper was analyzed using method EPA 200.7, following extraction by co-precipitation.

Semivolatile organics were all at the non-detect level with the exception of phenol, 4-methylphenol, and bis (2-Ethylhexyl) phthalate. Bis (2-Ethylhexyl) phthalate was detected at 31 μg/l. Phenol and 4-methylphenol are compared with past sample results in Table 3. Total recoverable phenols were detected at 180 μg/l.

The inorganics analyses detected three chemical parameters in the effluent from StarKist Samoa. Mercury was detected at the reported detection limit (0.0001 mg/l). Arsenic and zinc were detected at comparable levels with those previously reported. Table 3 summarizes the sample results for substances detected for the November 1998 effluent sample analysis compared to those detected during previous analyses.

Table 1
Effluent Sample Analyses and Handling Procedures
StarKist Samoa, 19 - 20 November 1998

Chemical Parameter	Analytical Method Requested	Detection Limits, µg/l		Sample Holding Time	Sample Container	Sample Preservation
		Requested	Achieved			
Semivolatile Organics	EPA 625	10-50	20-200	7 days	1 liter amber glass	4 °C
Phenols	EPA 420.1	10	40	28 days	500 ml plastic	4 °C 5 ml H_2SO_4[1]
Inorganics [2]						
Arsenic	EPA 206.2	5	2	6 months	500 ml plastic	4 °C, 5 ml 2N HNO_3 [1]
Cadmium	EPA 200.7	5	10	"	"	"
Chromium	EPA 200.7	10	20	"	"	"
Copper	EPA 220.2	2	10[3]	"	"	"
Lead	EPA 239.2	5	1	"	"	"
Mercury	EPA 245.1	0.4	0.1	"	"	"
Selenium	EPA 270.1	5	5	"	"	"
Silver	EPA 272.2	2	0.2	"	"	"
Zinc	EPA 200.7	20	20	"	"	"

[1] Additional HNO_3 and H_2SO_4 was added to the sample as necessary to bring pH equal to or less than 2 at the time of composting the sample.
[2] All Inorganics were from one 500 ml plastic sample container, preserved with 5 ml 2N HNO_3, with pH of filled sample bottle measured at 1.65. An un-preserved duplicate sample was taken for Copper analysis using co-precipitation.
[3] Method EPA 200.7 used to achieve this detection limit following extraction by co-precipitation.

Effluent Chemical Analysis
November 1998 Sampling
StarKist Samoa, Inc.

Table 2
Effluent Chemistry 24-hour Composite Sample Collection
StarKist Samoa, 19 - 20 November 1998

Grab Sample Number	Sampling Time	Sampling Date	Effluent Flow Rate (mgd)[1]	Percent of Total Flow	Volume of Sample (ml)	
					1 liter	500 ml
1	1200	11/19/98	1.82	14.7	147	74
2	1500	11/19/98	1.65	13.3	133	67
3	1800	11/19/98	1.29	10.4	10.4	52
4	2100	11/19/98	1.47	11.8	118	59
5	2400	11/19/98	1.46	11.8	118	59
6	0300	11/20/98	1.50	12.1	121	61
7	0600	11/20/98	1.61	13.0	130	65
8	0900	11/20/98	1.59	12.8	128	64
TOTALS			12.39	99.9	999	501

[1] Mean Effluent Flow Rate = 1.548 mgd.

Table 3
Summary of StarKist Samoa Effluent Chemistry Sample Results
February 1993 - November 1998

Substance	Previous Sample Results, µg/L (ppb)											Nov 1998 Sample Results, µg/L (ppb)
	Feb 1993	Oct 1993 [1]	Feb 1994	Oct 1994	Mar 1995	Feb 1996	Mar 1996	Nov 1996	Mar 1997	Sep 1997	Jun 1997	
Inorganics												
Arsenic	6.0	ND (14)	ND	9	ND [2]	ND	ND [3]	10	15	12	20	23
Cadmium	ND	ND	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	ND	(ND)	15	ND	6	13	ND [4]	5	4.7	4	ND	ND
Mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1 [8]
Selenium	ND	ND	ND [5]	ND [5]	ND [5]	ND [6]	ND [6]	15	ND	10	ND [7]	ND
Silver	130	33 (39)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	92	130 (180)	140	84	120	63	81	117	150	154	198	360
Semivolatile Organics												
Bis (2-Ethylhexyl) phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	31
Phenol	500	430	45	140	32	32	320	500	270	630	750	220
4-Methylphenol	260	530	360	290	310	130	370	490	310	240	500	680
Total Recoverable Phenols	NA	1300	120	15	34	72	510	440	290	140	660	180

ND = Not Detected NA = Not Analyzed
[1] Values in parentheses are results of reanalyzed samples (see Technical Memorandum for October 1993 sampling episode).
[2] Detection limit raised to 50 µg/l because of matrix interference.
[3] Detection limit raised to 400 µg/l because of matrix interference, with the resultant concentration <400 µg/l each time.
[4] Detection limit raised to 25 µg/l because of matrix interference, with the resultant concentration <25 µg/l.
[5] Detection limit raised to 50 µg/l because of matrix interference, with the resultant concentration <50 µg/l each time.
[6] Detection limit raised to 200 µg/l because of matrix interference, with the resultant concentration <200 µg/l.
[7] Detection limit raised to 10 µg/l because of matrix interference, with the resultant concentration <10 µg/l.
[8] Detection Limit = 0.1 µg/l for mercury.

ATTACHMENT I

CHAIN-OF-CUSTODY FORMS

StarKist Samoa, Inc. Effluent Sample

19 - 20 November 1998

Starkist Chem, etc.
Send to ARI

CH2MHILL Analytical Services
CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

LMG 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-1444 FAX (334) 271-3428
LRD 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244-4109
LKW Canviro Analytical Laboratories Inc, 50 Bathurst Unit 12, Waterloo, Ontario, Canada N2V 2C5, (519) 747-2575 FAX (519) 747-3806
CVO 2300 NW Walnut Boulevard, Corvallis, OR 97330 3638, (541) 752 4271 FAX (541) 752 0276

COC #

Project #	147323.JC.EM
Purchase Order #	
Project Name	Starkist Effluent Chemical Analy
Company Name	CH2M Hill / SEA
Project Manager or Contact & Phone #	Steve Costa / GDC 707-677-0123
Report Copy to:	Jim Crawford / CH2M Hill 425-453-5045 ex 5330
Requested Completion Date:	ASAP
Site ID	
Sample Disposal:	Dispose [ ] Return [ ]

Requested Analytical Method #: Semi-Vols EPA 625 | Total Phenol EPA 420.1 | Metals EPA 200 series *

Preservative

Date	Time	COMP	GRAB	WATER	SOIL	AIR	CLIENT SAMPLE ID (9 CHARACTERS)	LAB QC	TOTAL # OF CONTAINERS	Semi-Vols EPA 625	Total Phenol EPA 420.1	Metals EPA 200 series *		Alternate Description	Lab ID
11/19/98	24 HR	X		X			STARKIST		1	X				1 l Amber Glass	
"	"	X		X			STARKIST		1		X			500ml Poly w H_2SO_4	
"	"	X		X			STARKIST		1			X		500ml Poly w HNO_3	
"	"	X		X			STARKIST		1				X	500ml Poly unpreserved	

THIS AREA FOR LAB USE ONLY

Lab # | Page | of
Lab PM | Custody Review
Log In | LIMS Verification
pH | Custody Seals Y N | Ice Y N
QC Level 1 2 3 Other
Cooler Temperature

Z301
98-24233 →
98-24234

Relinquished By	Empty Bottles	Date/Time	Received By Amy Bergin Empty Bottles Bergin	Date/Time 11/23/98 950
Sampled By and Title	(Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Received By	(Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Received By	(Please sign and print name)	Date/Time	Shipped Via UPS Fed-Ex Other	Shipping #

Special Instructions: * See: Jennifer Baier / ARI for specific Methods + detection limits / Samples are 24 hr. composites of 24 hr. Hourly Collected.
Metals are As, Cd, Cr, Cu, Pb, Hg, Se, Ag, Zn

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Chain of Custody Record & Laboratory Analysis Request

Date: 11/20/98
Page 1 of
Number of coolers: 1
Cooler Temp:

Analytical Resources, Incorporated
Analytical Chemist and Consultants
400 Ninth Avenue North
Seattle, WA 98109-4708
(206) 621-6490
(206) 621-7523 (Fax)

ARI Client: Jennifer Baier Phone#: (206) 621-6490

Client Contact: Steve Costa (707) 826-0717

Client Project ID: 147323. JC. EM

Samplers:

	Sample ID	Date	Time	Matx	No Cont	Lab ID	ARSENIC (206.2)	CADMIUM (200.7)	CHROMIUM (200.7)	LEAD (239.2/200.7.5)	MERCURY (245.1)	SELENIUM (270.1/200.7)	SILVER (272.2)	ZINC (200.7)	Notes/Comments
1	SKS - MT	11/20			1		X	X	X	X	X	X	X	X	Preservative: MT — HNO_3
2															
3															
4															
5															
6															
7															

ARI Project No:

T.A.T. Requested:

Comments/Special Instructions:

Relinquished by: (Signature)	Lesina Sivatia (signature)	Lesina Sivatia (signature)	Lesina Sivatia (signature)
Printed Name:	Lesina Sivatia	Lesina Sivatia	Lesina Sivatia
Company:	Star Kist Samoa	Star Kist Samoa	Star Kist Samoa
Date / Time:	Date: 11/20/98 Time:	Date: Time:	Date: 11/20/98 Time:
Received by: (Signature)	Amy Bergin (signature)		
Printed Name:	Amy Bergin		
Company:	ARI		
Date / Time:	Date: 11/23/98 Time: 950	Date: Time:	Date: Time:

Limits of Liability: ARI will perform all requested services in accordance with appropriate methodology following Standard Operating Procedures and our Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the invoiced amount for said services. The acceptance by the client of a proposal for services by ARI releases ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the client.

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Chain of Custody Record & Laboratory Analysis Request

Date: 11/20/98
Page 1 of
Number of coolers: 1
Cooler Temp:

Analytical Resources, Incorporated
Analytical Chemist and Consultants
400 Ninth Avenue North
Seattle, WA 98109-4708
(206) 621-6490
(206) 621-7523 (Fax)

ARI Client: Jennifer Baier Phone#: (206) 621-6490

Client Contact: Steve Costa (707) 826-0717

Client Project ID: 147323.JC.EM

Samplers:

	Sample ID	Date	Time	Matx	No Cont	Lab ID	Total Phenols	Semi Volatiles		COPPER (220.2)					Notes/Comments
															Preservative. UM - None SV - None PH - H_2SO_4
1	SKS - PH	11/20			1		X								
2	SKS - SV	"			1			X							
3	SKS - UM	"			1					X					
4															
5															
6															
7															

ARI Project No:

T.A.T. Requested:

Comments/Special Instructions:

Relinquished by: (Signature) Lasina Sivatia	Relinquished by: (Signature) Lasina Sivatia	Relinquished by: (Signature) Lasina Sivatia
Printed Name: Lasina Sivatia	Printed Name: Lasina Sivatia	Printed Name: Lasina Sivatia
Company: Star Kist Samoa	Company: Star Kist Samoa	Company: Star Kist Samoa
Date: 11/20/98 Time:	Date: 11/20/98 Time:	Date: 11/20/98 Time:
Received by: (Signature) Amy Berg	Received by: (Signature)	Received by: (Signature)
Printed Name: Amy Bergin	Printed Name:	Printed Name:
Company: ARI	Company:	Company:
Date: 11/23/98 Time: 950	Date: Time:	Date: Time:

Limits of Liability: ARI will perform all requested services in accordance with appropriate methodology following Standard Operating Procedures and our Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the invoiced amount for said services. The acceptance by the client of a proposal for services by ARI releases ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the client.

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ATTACHMENT II

LABORATORY DATA REPORT
Analytical Resources, Inc.

StarKist Samoa, Inc. Effluent Sample

19 - 20 November 1998

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS

ANALYTICAL RESOURCES INCORPORATED

Sample No: **STARKIST DILUTION**

Lab Sample ID: Z301A-DL
LIMS ID: 98-24233
Matrix: Water
Data Release Authorized: mw
Reported: 12/07/98

QC Report No: Z301-CH2M Hill, Incorporated
Project: Starkist effluent
147323.JC.EM
Date Sampled: 11/19/98
Date Received: 11/23/98

Date extracted: 11/23/98
Date analyzed: 12/02/98
Instrument: ntl

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:20

CAS Number	Analyte	ug/L
108-95-2	**Phenol**	**220**
111-44-4	Bis-(2-Chloroethyl) Ether	40 U
95-57-8	2-Chlorophenol	20 U
541-73-1	1,3-Dichlorobenzene	20 U
106-46-7	1,4-Dichlorobenzene	20 U
100-51-6	Benzyl Alcohol	100 U
95-50-1	1,2-Dichlorobenzene	20 U
95-48-7	2-Methylphenol	40 U
108-60-1	2,2'-Oxybis(1-Chloropropane)	20 U
106-44-5	**4-Methylphenol**	**680**
621-64-7	N-Nitroso-Di-N-Propylamine	40 U
67-72-1	Hexachloroethane	40 U
98-95-3	Nitrobenzene	20 U
78-59-1	Isophorone	20 U
88-75-5	2-Nitrophenol	100 U
105-67-9	2,4-Dimethylphenol	60 U
65-85-0	Benzoic Acid	200 U
111-91-1	bis(2-Chloroethoxy) Methane	20 U
120-83-2	2,4-Dichlorophenol	60 U
120-82-1	1,2,4-Trichlorobenzene	20 U
91-20-3	Naphthalene	20 U
106-47-8	4-Chloroaniline	60 U
87-68-3	Hexachlorobutadiene	40 U
59-50-7	4-Chloro-3-methylphenol	40 U
91-57-6	2-Methylnaphthalene	20 U
77-47-4	Hexachlorocyclopentadiene	100 U
88-06-2	2,4,6-Trichlorophenol	100 U
95-95-4	2,4,5-Trichlorophenol	100 U
91-58-7	2-Chloronaphthalene	20 U
88-74-4	2-Nitroaniline	100 U
131-11-3	Dimethylphthalate	20 U
208-96-8	Acenaphthylene	20 U
99-09-2	3-Nitroaniline	120 U
83-32-9	Acenaphthene	20 U
51-28-5	2,4-Dinitrophenol	200 U
100-02-7	4-Nitrophenol	100 U
132-64-9	Dibenzofuran	20 U
606-20-2	2,6-Dinitrotoluene	100 U

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 2 of 2

Sample No: **STARKIST DILUTION**

Lab Sample ID: Z301A-DL
LIMS ID: 98-24233
Matrix: Water
Data Release Authorized: MV
Reported: 12/07/98

QC Report No: Z301-CH2M Hill, Incorporated
Project: Starkist effluent
147323.JC.EM
Date Sampled: 11/19/98
Date Received: 11/23/98

Date extracted: 11/23/98
Date analyzed: 12/02/98
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:20

CAS Number	Analyte	ug/L
121-14-2	2,4-Dinitrotoluene	100 U
84-66-2	Diethylphthalate	20 U
7005-72-3	4-Chlorophenyl-phenylether	20 U
86-73-7	Fluorene	20 U
100-01-6	4-Nitroaniline	100 U
534-52-1	4,6-Dinitro-2-Methylphenol	200 U
86-30-6	N-Nitrosodiphenylamine	20 U
101-55-3	4-Bromophenyl-phenylether	20 U
118-74-1	Hexachlorobenzene	20 U
87-86-5	Pentachlorophenol	100 U
85-01-8	Phenanthrene	20 U
86-74-8	Carbazole	20 U
120-12-7	Anthracene	20 U
84-74-2	Di-n-Butylphthalate	20 U
206-44-0	Fluoranthene	20 U
129-00-0	Pyrene	20 U
85-68-7	Butylbenzylphthalate	20 U
91-94-1	3,3'-Dichlorobenzidine	100 U
56-55-3	Benzo(a)anthracene	20 U
117-81-7	**bis(2-Ethylhexyl)phthalate**	**31**
218-01-9	Chrysene	20 U
117-84-0	Di-n-Octyl phthalate	20 U
205-99-2	Benzo(b)fluoranthene	20 U
207-08-9	Benzo(k)fluoranthene	20 U
50-32-8	Benzo(a)pyrene	20 U
193-39-5	Indeno(1,2,3-cd)pyrene	20 U
53-70-3	Dibenz(a,h)anthracene	20 U
191-24-2	Benzo(g,h,i)perylene	20 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	64.8%	d5-Phenol	69.9%
2-Fluorobiphenyl	57.6%	2-Fluorophenol	89.6%
d14-p-Terphenyl	46.4%	2,4,6-Tribromophenol	84.8%
d4-1,2-Dichlorobenzene	68.0%	d4-2-Chlorophenol	70.9%

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 2

Sample No: Method Blank

Lab Sample ID: Z301MB
LIMS ID: 98-24233
Matrix: Water
Data Release Authorized: MW
Reported: 12/07/98

QC Report No: Z301-CH2M Hill, Incorporated
Project: Starkist effluent
147323.JC.EM
Date Sampled: NA
Date Received: NA

Date extracted: 11/23/98
Date analyzed: 12/01/98
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:1

CAS Number	Analyte	ug/L
108-95-2	Phenol	2.0 U
111-44-4	Bis-(2-Chloroethyl) Ether	2.0 U
95-57-8	2-Chlorophenol	1.0 U
541-73-1	1,3-Dichlorobenzene	1.0 U
106-46-7	1,4-Dichlorobenzene	1.0 U
100-51-6	Benzyl Alcohol	5.0 U
95-50-1	1,2-Dichlorobenzene	1.0 U
95-48-7	2-Methylphenol	2.0 U
108-60-1	2,2'-Oxybis(1-Chloropropane)	1.0 U
106-44-5	4-Methylphenol	1.0 U
621-64-7	N-Nitroso-Di-N-Propylamine	2.0 U
67-72-1	Hexachloroethane	2.0 U
98-95-3	Nitrobenzene	1.0 U
78-59-1	Isophorone	1.0 U
88-75-5	2-Nitrophenol	5.0 U
105-67-9	2,4-Dimethylphenol	3.0 U
65-85-0	Benzoic Acid	10 U
111-91-1	bis(2-Chloroethoxy) Methane	1.0 U
120-83-2	2,4-Dichlorophenol	3.0 U
120-82-1	1,2,4-Trichlorobenzene	1.0 U
91-20-3	Naphthalene	1.0 U
106-47-8	4-Chloroaniline	3.0 U
87-68-3	Hexachlorobutadiene	2.0 U
59-50-7	4-Chloro-3-methylphenol	2.0 U
91-57-6	2-Methylnaphthalene	1.0 U
77-47-4	Hexachlorocyclopentadiene	5.0 U
88-06-2	2,4,6-Trichlorophenol	5.0 U
95-95-4	2,4,5-Trichlorophenol	5.0 U
91-58-7	2-Chloronaphthalene	1.0 U
88-74-4	2-Nitroaniline	5.0 U
131-11-3	Dimethylphthalate	1.0 U
208-96-8	Acenaphthylene	1.0 U
99-09-2	3-Nitroaniline	6.0 U
83-32-9	Acenaphthene	1.0 U
51-28-5	2,4-Dinitrophenol	10 U
100-02-7	4-Nitrophenol	5.0 U
132-64-9	Dibenzofuran	1.0 U
606-20-2	2,6-Dinitrotoluene	5.0 U

FORM-1

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS

Sample No: Method Blank

Lab Sample ID: Z301MB
LIMS ID: 98-24233
Matrix: Water
Data Release Authorized:
Reported: 12/07/98

QC Report No: Z301-CH2M Hill, Incorporated
Project: Starkist effluent
147323.JC.EM
Date Sampled: NA
Date Received: NA

Date extracted: 11/23/98
Date analyzed: 12/01/98
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:1

CAS Number	Analyte	ug/L
121-14-2	2,4-Dinitrotoluene	5.0 U
84-66-2	Diethylphthalate	1.0 U
7005-72-3	4-Chlorophenyl-phenylether	1.0 U
86-73-7	Fluorene	1.0 U
100-01-6	4-Nitroaniline	5.0 U
534-52-1	4,6-Dinitro-2-Methylphenol	10 U
86-30-6	N-Nitrosodiphenylamine	1.0 U
101-55-3	4-Bromophenyl-phenylether	1.0 U
118-74-1	Hexachlorobenzene	1.0 U
87-86-5	Pentachlorophenol	5.0 U
85-01-8	Phenanthrene	1.0 U
86-74-8	Carbazole	1.0 U
120-12-7	Anthracene	1.0 U
84-74-2	Di-n-Butylphthalate	1.0 U
206-44-0	Fluoranthene	1.0 U
129-00-0	Pyrene	1.0 U
85-68-7	Butylbenzylphthalate	1.0 U
91-94-1	3,3'-Dichlorobenzidine	5.0 U
56-55-3	Benzo(a)anthracene	1.0 U
117-81-7	bis(2-Ethylhexyl)phthalate	1.0 U
218-01-9	Chrysene	1.0 U
117-84-0	Di-n-Octyl phthalate	1.0 U
205-99-2	Benzo(b)fluoranthene	1.0 U
207-08-9	Benzo(k)fluoranthene	1.0 U
50-32-8	Benzo(a)pyrene	1.0 U
193-39-5	Indeno(1,2,3-cd)pyrene	1.0 U
53-70-3	Dibenz(a,h)anthracene	1.0 U
191-24-2	Benzo(g,h,i)perylene	1.0 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	77.0%	d5-Phenol	64.6%
2-Fluorobiphenyl	61.5%	2-Fluorophenol	84.2%
d14-p-Terphenyl	80.5%	2,4,6-Tribromophenol	85.3%
d4-1,2-Dichlorobenzene	59.2%	d4-2-Chlorophenol	70.3%

FORM-1

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 1

Lab Sample ID: Z301SB
LIMS ID: 98-24233
Matrix: Water

QC Report No: Z301-CH2M Hill, Incorporated
Project: Starkist effluent
147323.JC.EM

Data Release Authorized:
Reported: 12/07/98

LABORATORY CONTROL SAMPLE
Date extracted: 11/23/98
Date analyzed: 12/01/98

CONSTITUENT	SPIKE VALUE	SPIKE ADDED	% RECOVERY
Phenol	30.1	37.5	80.3%
2-Chlorophenol	31.9	37.5	85.1%
1,4-Dichlorobenzene	15.3	25.0	61.2%
N-Nitroso-Di-N-Propylamine	16.0	25.0	64.0%
1,2,4-Trichlorobenzene	16.1	25.0	64.4%
4-Chloro-3-methylphenol	29.4	37.5	78.4%
Acenaphthene	21.4	25.0	85.6%
4-Nitrophenol	42.8	37.5	114%
2,4-Dinitrotoluene	21.9	25.0	87.6%
Pentachlorophenol	22.0	37.5	58.7%
Pyrene	23.4	25.0	93.6%

Lab Control Surrogate Recovery

d5-Nitrobenzene	78.9%	d5-Phenol	74.9%
2-Fluorobiphenyl	62.8%	2-Fluorophenol	84.3%
d14-p-Terphenyl	86.0%	2,4,6-Tribromophenol	84.2%
d4-1,2-Dichlorobenzene	62.4%	d4-2-Chlorophenol	77.7%

Reported in Total ug/L

FORM-III

ANALYTICAL
RESOURCES
INCORPORATED

WATER SEMIVOLATILE SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: Z301-CH2M Hill, Incorporated
Project: Starkist effluent
147323.JC.EM

Client ID	NBZ	FBP	TPH	PHL	2FP	TBP	2CP	DCB	TOT OUT
Method Blank	77.0%	61.5%	80.5%	64.6%	84.2%	85.3%	70.3%	59.2%	0
Lab Control	78.9%	62.8%	86.0%	74.9%	84.3%	84.2%	77.7%	62.4%	0
STARKIST	80.3%	75.2%	54.1%	45.1%	130% *	96.5%	76.5%	48.5%	1
STARKIST-DL	64.8%	57.6%	46.4%	69.9%	89.6%	84.8%	70.9%	68.0%	0

LIQUID-LIQUID SW3520B

	LCS/MB LIMITS	QC LIMITS
(NBZ) = Nitrobenzene-d5	(49-109)	(43-110)
(FBP) = 2-Fluorobiphenyl	(46-100)	(45-103)
(TPH) = p-Terphenyl-d14	(50-134)	(29-145)
(PHL) = Phenol-d5	(26-119)	(32-116)
(2FP) = 2-Fluorophenol	(42-109)	(38-106)
(TBP) = 2,4,6-Tribromophenol	(44-120)	(45-129)
(2CP) = 2-Chlorophenol-d4	(54-108)	(48-108)
(DCB) = 1,2-Dichlorobenzene-d4	(36-100)	(35-100)

\# Column to be used to flag recovery values

* Values outside of required QC limits

D Surrogate Compound diluted out

FORM-II SVOA-1

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample No: STARKIST

Lab Sample ID: Z301A
LIMS ID: 98-24233
Matrix: Water

QC Report No: Z301-CH2M Hill, Incorporated
Project: Starkist effluent
147323.JC.EM
Date Sampled: 11/19/98
Date Received: 11/23/98

Data Release Authorized:
Reported: 12/09/98

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
7060	12/01/98	7060	12/07/98	**7440-38-2**	**Arsenic**	0.002	**0.023**
3010	12/01/98	6010	12/07/98	7440-43-9	Cadmium	0.01	0.01 U
3010	12/01/98	6010	12/07/98	7440-47-3	Chromium	0.02	0.02 U
3010	12/01/98	6010	12/07/98	7440-50-8	Copper	0.01	0.01 U
3020	12/01/98	7421	12/04/98	7439-92-1	Lead	0.001	0.001 U
7470	12/01/98	7470	12/03/98	**7439-97-6**	**Mercury**	0.0001	**0.0001**
7740	12/01/98	7740	12/04/98	7782-49-2	Selenium	0.005	0.005 U
3020	12/01/98	7761	12/03/98	7440-22-4	Silver	0.0002	0.0002 U
3010	12/01/98	6010	12/07/98	**7440-66-6**	**Zinc**	0.02	**0.36**

U Analyte undetected at given RL

RL Reporting Limit

FORM-I

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample No: Method Blank

Lab Sample ID: Z300MB
LIMS ID: 98-24231
Matrix: Water

QC Report No: Z300-CH2M Hill, Incorporated
Project: Chicken of the Sea- effluent

Date Sampled: NA
Date Received: NA

Data Release Authorized:
Reported: 12/09/98

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
7060	12/01/98	7060	12/07/98	7440-38-2	Arsenic	0.001	0.001 U
3010	12/01/98	6010	12/07/98	7440-43-9	Cadmium	0.002	0.002 U
3010	12/01/98	6010	12/07/98	7440-47-3	Chromium	0.005	0.005 U
3010	12/01/98	6010	12/07/98	7440-50-8	Copper	0.002	0.002 U
3020	12/01/98	7421	12/04/98	7439-92-1	Lead	0.001	0.001 U
7470	12/01/98	7470	12/03/98	7439-97-6	Mercury	0.0001	0.0001 U
7740	12/01/98	7740	12/04/98	7782-49-2	Selenium	0.001	0.001 U
3020	12/01/98	7761	12/03/98	7440-22-4	Silver	0.0002	0.0002 U
3010	12/01/98	6010	12/07/98	**7440-66-6**	**Zinc**	0.004	**0.004**

U Analyte undetected at given RL

RL Reporting Limit

FORM-I

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

ANALYTICAL
RESOURCES
INCORPORATED

Lab Sample ID: Z300LCS
LIMS ID: 98-24231
Matrix: Water

QC Report No: Z300-CH2M Hill, Incorporated
Project: Chicken of the Sea- effluent

Data Release Authorized:
Reported: 12/09/98

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Spike mg/L	Spike Added	% Recovery	Q
Arsenic	0.039	0.040	97.5%	
Cadmium	0.045	0.050	90.0%	
Chromium	0.200	0.200	100%	
Copper	0.257	0.250	103%	
Lead	0.022	0.020	110%	
Mercury	0.0020	0.0020	100%	
Selenium	0.009	0.010	90.0%	
Silver	0.019	0.020	95.0%	
Zinc	0.504	0.500	101%	

'Q' codes: N = control limit not met

Control Limits: 80-120%

FORM-VII

ANALYTICAL
RESOURCES
INCORPORATED

Final Report
Laboratory Analysis of Conventional Parameters

Sample No: STARKIST

Lab Sample ID: Z301A
LIMS ID: 98-24233
Matrix: Water

QC Report No: Z301-CH2M Hill, Incorporated
Project: Starkist effluent
147323.JC.EM
Date Sampled: 11/19/98
Date Received: 11/23/98

Data Release Authorized:
Reported: 12/08/98 Dr. M.A. Perkins

Analyte	Analysis Date & Batch	Method	RL	Units	Result
Phenol	12/01/98 120198#1	EPA 420.1	0.04	mg/L	0.18

RL Analytical reporting limit
U Undetected at reported detection limit

Report for Z301 received 11/23/98

ANALYTICAL
RESOURCES
INCORPORATED

QA Report - Method Blank Analysis

QC Report No: Z301-CH2M Hill, Incorporated
Matrix: Water
Project: Starkist effluent
147323.JC.EM
Date Received: NA
Data Release Authorized: MP
Reported: 12/08/98 Dr. M.A. Perkins

METHOD BLANK RESULTS
CONVENTIONALS

Analysis Date & Batch	Constituent	Units	Result	
12/01/98 120198#1	Phenol	mg/L	< 0.04	U

ANALYTICAL
RESOURCES
INCORPORATED

QA Report - Laboratory Control Samples

QC Report No: Z301-CH2M Hill, Incorporated
Project: Starkist effluent
147323.JC.EM
Date Received: NA

Data Release Authorized:
Reported: 12/08/98 Dr. M.A. Perkins

LABORATORY CONTROL SAMPLES
CONVENTIONALS

Constituent	Units	Measured Value	True Value	Recovery
Laboratory Control Sample				
Phenol	mg/L	0.10	0.13	76.9%

Date analyzed: 12/01/98 Batch ID: 120198#1

ANALYTICAL
RESOURCES
INCORPORATED

QA Report - Standard Reference Material Analysis

QC Report No: Z301-CH2M Hill, Incorporated
Project: Starkist effluent
147323.JC.EM
Date Received: NA

Data Release Authorized:
Reported: 12/08/98 Dr. M.A. Perkins

STANDARD REFERENCE MATERIAL ANALYSIS
CONVENTIONALS

Constituent	Units	Value	True Value	Recovery
EM #36141630				
Phenol	mg/L	0.13	0.13	100%

Date analyzed: 12/01/98 Batch ID: 120198#1

ANALYTICAL
RESOURCES
INCORPORATED

QA Report - Matrix Spike/Matrix Spike Duplicate Analysis

Matrix: Water

QC Report No: Z301-CH2M Hill, Incorporated
Project: Starkist effluent
147323.JC.EM
Date Received: 11/23/98

Data Release Authorized:
Reported: 12/08/98 Dr. M.A. Perkins

MATRIX SPIKE QA/QC REPORT
CONVENTIONALS

Constituent	Units	Sample Value	Spike Value	Spike Added	Recovery
ARI ID: 98-24233, Z301 A Client Sample ID: STARKIST					
Phenol	mg/L	0.18	0.51	0.47	70.2%

MS/MSD Recovery Limits: 75 - 125 %

'

TECHNICAL MEMORANDUM

PREPARED FOR: Chicken of the Sea (COS) Samoa Packing Company, Inc. (NPDES Permit AS0000027)

PREPARED BY: Steve Costa and Karen Glatzel/gdc
David Wilson/CH2M HILL/SEA

DATE: 31 December 1999

SUBJECT: **Chemical Analysis of Effluent: November 1998 Sampling**

PROJECT: 147323.JC.EM

Purpose

This memorandum presents the results of the chemical analyses of COS Samoa Packing effluent samples that were collected in November 1998. This was the twelfth sampling and analysis episode conducted under the current NPDES permit.

Study Objectives

Section D.2 of COS Samoa Packing's NPDES permit (AS0000027) requires that semiannual priority pollutant analyses be conducted on the cannery effluent. Each effluent sampling event must coincide with effluent sampling for acute biomonitoring. Effluent samples are collected as composite samples as described below. The purpose of these analyses is to identify the chemicals present in the effluent, and provide data to determine whether the wastewater discharge complies with water quality standards.

Effluent priority pollutant analyses include those chemical constituents listed in 40 CFR 401.15. As documented in the Technical Memorandum describing the results of the March 1995 sampling (CH2M HILL, 20 June 1995) the U.S. Environmental Protection Agency Region 9 has allowed COS Samoa Packing to exclude a number of previously measured constituents in the priority pollutant list. The constituents currently included in the effluent chemistry analyses are listed in Table 1.

Methods

Between 1200 on 19 November and 0900 on 20 November 1998, a 24-hour, flow-weighted composite sample of final effluent was collected from the COS Samoa Packing treatment plant discharge. Effluent composite samples were collected simultaneously for chemistry and bioassay analyses. Table 1 lists the chemical analyses, detection limits, sample holding times, sample containers, and sample preservations for the effluent sample collected for chemical analysis. The standard operating procedures (SOP) for the joint cannery outfall chemistry sampling is provided in the Technical Memorandum describing the bioassay tests conducted with the March 1995 effluent sample (CH2M HILL, 20 June 1995).

Samples were collected from the established effluent sampling site following the established composite sample collection schedule for the priority pollutant analyses. A total of eight individual grab samples were collected into pre-cleaned glass containers at approximately three-hour intervals over a 24 hour period. The samples were stored on ice until the completion of the 24-hour sampling period, and then a flow-weighted composite sample was prepared. The grab sample collection times and the calculated individual volumes of each grab sample used to create the composite sample, based on COS Samoa Packing's flow records, are summarized in Table 2. The final composite sample was used to fill the sample containers sent to the laboratory for analyses. The pH of the samples for analysis of metals and total phenol was measured prior to shipping and was less than 2.0 SU. A duplicate sample was taken and shipped without preservative for copper analysis using co-precipitation.

Sample containers were wrapped in bubble-wrap, placed in zip-lock bags, and packed on ice for shipment to the laboratory. Sample chain of custody forms were completed, sealed into zip-lock bags, and taped inside the lid of the ice chest. Samples were shipped to the laboratory via DHL. Samples that were composited on 20 November, were received at Analytical Resources, Incorporated (ARI) 23 November 1998.

Results

Laboratory data sets, laboratory quality control data reports, and chain-of-custody form are attached to this memorandum. The chain-of-custody form is included as Attachment I and the laboratory analytical data sheets and quality control data reports are included as Attachment II. Table 1 indicates the detection limits requested from the analytical laboratory along with those achieved during the analysis. The laboratory indicated, prior to sample analysis, that the requested detection limits could be achieved. In order to achieve requested detection limit, copper was analyzed using method EPA 200.7, following extraction by co-precipitation.

Semivolatile organics were all at the non-detect level with the exception of phenol, 4-methylphenol, and bis (2-Ethylhexyl) phthalate. Bis (2-Ethylhexyl) phthalate was detected at 79 μg/l. Phenol and 4-methylphenol are compared with past sample results in Table 3. Total recoverable phenols were detected at 60 μg/l.

Table 3 summarizes the sample results for substances detected for the November 1998 effluent sample analysis compared to those detected during previous analyses. The analyses detected six chemical parameters in the effluent from COS Samoa Packing. Arsenic, copper, selenium, and zinc were detected at comparable levels with those previously reported. Cadmium was detected at 3 μg/l and lead was detected at 2 μg/l, both near the reported limit of detection (2 μg/l and1 μg/l respectively).

Table 1
Effluent Sample Analyses and Handling Procedures
COS Samoa Packing, 19 - 20 November 1998

Chemical Parameter	Analytical Method Requested	Detection Limits, µg/l		Sample Holding Time	Sample Container	Sample Preservation
		Requested	Achieved			
Semivolatile Organics	EPA 625	10-50	20-200	7 days	1 liter amber glass	4 °C
Phenols	EPA 420.1	10	40	28 days	500 ml plastic	4 °C, 5 ml H_2SO_4 [1]
Inorganics [2]						
Arsenic	EPA 206.2	5	2	6 months	500 ml plastic	4 °C, 5 ml 2N HNO_3 [1]
Cadmium	EPA 200.7	5	2	"	"	"
Chromium	EPA 200.7	10	5	"	"	"
Copper	EPA 220.2	2	2[3]	"	"	"
Lead	EPA 239.2	5	1	"	"	"
Mercury	EPA 245.1	0.4	0.1	"	"	"
Selenium	EPA 270.1	5	5	"	"	"
Silver	EPA 272.2	2	0.2	"	"	"
Zinc	EPA 200.7	20	4	"	"	"

[1] Additional HNO_3 and H_2SO_4 was added to the sample as necessary to bring pH equal to or less than 2 at the time of composting the sample.
[2] All Inorganics were from one 500 ml plastic sample container, preserved with 5 ml 2N HNO_3, with pH of filled sample bottle measured at 1.65. An un-preserved duplicate sample was taken for Copper analysis using co-precipitation.
[3] Method EPA 200.7 used to achieve this detection limit following extraction by co-precipitation.

Table 2
Effluent Chemistry 24-hour Composite Sample Collection
COS Samoa Packing, 19 - 20 November 1998

Grab Sample Number	Sampling Time	Sampling Date	Effluent Flow Rate (mgd)[1]	Percent of Total Flow	Volume of Sample (ml)	
					1 liter	500 ml
1	1200	11/19/98	0.88	13.1	131	65.5
2	1500	11/19/98	0.88	13.1	131	65.5
3	1800	11/19/98	0.88	13.1	131	65.5
4	2100	11/19/98	0.80	11.9	119	59.5
5	2400	11/19/98	0.80	11.9	119	59.5
6	0300	11/20/98	0.80	11.9	119	59.5
7	0600	11/20/98	0.80	11.9	119	59.5
8	0900	11/20/98	0.90	13.4	134	67
TOTALS			6.74	100.3	1003	501.5

[1] Mean effluent flow rate 0.84 mgd.

Table 3
Summary of COS Samoa Packing Effluent Chemistry Sample Results
February 1993 - November 1998

Substance	Previous Sample Results, µg/L (ppb)											Nov 1998 Sample Results,
	Feb 1993	Oct 1993 [1]	Feb 1994	Oct 1994	Mar 1995	Feb 1996	Mar 1996	Nov 1996	Mar 1997	Sep 1997	Jun 1997	µg/L (ppb) 1998
Inorganics												
Arsenic	9.8	ND (15)	25	25	32	14	ND [2]	16	24	24	21	18
Cadmium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3
Copper	21	(ND) (ND)	13	23	9	54	ND [3]	11	11	12	24	12
Lead		ND	ND	ND	ND	ND	ND	ND	ND	ND	2	2
Selenium	4.3	ND (2.5)	ND	ND	ND	5.4	ND	ND	2	ND	12	7
Silver	ND	ND	22	16	33	<50 [4]	ND [5]	ND	ND	ND	ND	ND
Zinc	380	400 (540)	660	760	570	440	740	471	484	585	657	585
Semivolatile Organics												
Benzoic Acid	120	ND	ND	ND	ND	ND	ND	ND	ND	53 [6]	ND	ND
Bis (2-Ethylhexyl) phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	79
Phenol	110	ND	69	120	32	110	89	150	73	52	51	65
4-Methylphenol	670	1600	770	2800	2400	1600	6800	1800	860	1600	420	430
Total Recoverable Phenols	NA	570	84	280	150	170	170	140	80	70	70	60

ND = Not Detected NA = Not Analyzed
[1] Values in parentheses are results of reanalyzed samples (see Technical Memorandum for October 1993 sampling episode).
[2] Detection limit raised to 400 µg/l because of matrix interference, with the resultant concentration <400 µg/l each time.
[3] Detection limit raised to 25 µg/l because of matrix interference, with the resultant concentration <25 µg/l.
[4] Detection limit raised to 50 µg/l because of matrix interference, with the resultant concentration <50 µg/l each time.
[5] Detection limit raised to 200 µg/l because of matrix interference, with the resultant concentration <200 µg/l.
[6] Detected at dilution 1:3, ND at dilution 1:40.

ATTACHMENT I

CHAIN-OF-CUSTODY FORMS

COS Samoa Packing Company, Inc. Effluent Sample

19 - 20 November 1998

Cos Chemistry
Send to ARI

Lew

CH2MHILL Analytical Services
CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

LMG 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-1444 FAX (334) 271-3428
LRD 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244-4109
LKW Canviro Analytical Laboratories, Inc, 50 Bathurst, Unit 12, Waterloo, Ontario, Canada N2V 2C5, (519) 747-2575 FAX (519) 747-3806
CVO 2300 NW Walnut Boulevard, Corvallis, OR 97330 3638, (541) 752 4271 FAX (541) 752 0276

COC #

Project # 147323.JC.EM
Purchase Order #
Project Name Chicken-of-the-Sea Effluent Chemical Analysis
Company Name CH2M-Hill/SEA
Project Manager or Contact & Phone # Steve Costa 707-677-0123
Report Copy to: Jim Crawford/CH2M Hill 425-453-5005 ext 5330
Requested Completion Date:
Site ID
Sample Disposal: Dispose ☐ Return ☐

Requested Analytical Method #: Semi-Vols EPA 625 | Total Phenol EPA 420.1 | Metals EPA 200 series*

Preservative

Date	Time	COMP	GRAB	WATER	SOIL	AIR	CLIENT SAMPLE ID (9 CHARACTERS)	LAB QC	TOTAL # OF CONTAINERS	Semi-Vols EPA 625	Total Phenol EPA 420.1	Metals	EPA 200 series*	Alternate Description	Lab ID
11/19/98	24HR	X		X			COS-SAMOA		1	X				1l Amber Glass	
		X		X			COS-SAMOA		1		X			500ml Poly w H2SO4	
		X		X			COS-SAMOA		1			X		500ml Poly w HNO3	
		X		X			COS-SAMOA		1			X		500ml Poly unpreserved	

THIS AREA FOR LAB USE ONLY
Lab # | Page | of
Lab PM | Custody Review
Log In | LIMS Verification
pH | Custody Seals Y N | Ice Y N
QC Level 1 2 3 Other
Cooler Temperature

98-24231 →
98-24232
Z300

Relinquished By	Empty Bottles	Date/Time	Received By	Empty Bottles	Date/Time
Sampled By and Title (Please sign and print name): Felicita Pepito		Date/Time: 11/20/98	Relinquished By (Please sign and print name): FELICITA PEPITO		Date/Time: 11/20/98 1:10 P.M.
Received By (Please sign and print name): Bergin		Date/Time: 11/23/98 850	Relinquished By (Please sign and print name)		Date/Time
Received By (Please sign and print name)		Date/Time	Shipped Via: UPS Fed-Ex Other	Shipping #	

Special Instructions: *See Jennifer Baier/ARI for specific Methods + Detection limits / Samples are 24hr Composites at Cannery Effluent
*Metals: As, Cd, Cr, Cu, Pb, Hg, Se, Ag, Zn

Instructions and Agreement Provisions on Reverse Side

ATTACHMENT II

LABORATORY DATA REPORT
Analytical Resources, Inc.

COS Samoa Packing Company, Inc. Effluent Sample

19 - 20 November 1998

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 2

ANALYTICAL
RESOURCES
INCORPORATED

Sample No: **COS-SAMOA DILUTION**

Lab Sample ID: Z300A-DL
LIMS ID: 98-24231
Matrix: Water
Data Release Authorized: ΓΜ
Reported: 12/07/98

QC Report No: Z300-CH2M Hill, Incorporated
Project: Chicken of the Sea- effluent

Date Sampled: 11/19/98
Date Received: 11/23/98

Date extracted: 11/23/98
Date analyzed: 12/02/98
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:20

CAS Number	Analyte	ug/L	
108-95-2	**Phenol**	**65**	
111-44-4	Bis-(2-Chloroethyl) Ether	40	U
95-57-8	2-Chlorophenol	20	U
541-73-1	1,3-Dichlorobenzene	20	U
106-46-7	1,4-Dichlorobenzene	20	U
100-51-6	Benzyl Alcohol	100	U
95-50-1	1,2-Dichlorobenzene	20	U
95-48-7	2-Methylphenol	40	U
108-60-1	2,2'-Oxybis(1-Chloropropane)	20	U
106-44-5	**4-Methylphenol**	**430**	
621-64-7	N-Nitroso-Di-N-Propylamine	40	U
67-72-1	Hexachloroethane	40	U
98-95-3	Nitrobenzene	20	U
78-59-1	Isophorone	20	U
88-75-5	2-Nitrophenol	100	U
105-67-9	2,4-Dimethylphenol	60	U
65-85-0	Benzoic Acid	200	U
111-91-1	bis(2-Chloroethoxy) Methane	20	U
120-83-2	2,4-Dichlorophenol	60	U
120-82-1	1,2,4-Trichlorobenzene	20	U
91-20-3	Naphthalene	20	U
106-47-8	4-Chloroaniline	60	U
87-68-3	Hexachlorobutadiene	40	U
59-50-7	4-Chloro-3-methylphenol	40	U
91-57-6	2-Methylnaphthalene	20	U
77-47-4	Hexachlorocyclopentadiene	100	U
88-06-2	2,4,6-Trichlorophenol	100	U
95-95-4	2,4,5-Trichlorophenol	100	U
91-58-7	2-Chloronaphthalene	20	U
88-74-4	2-Nitroaniline	100	U
131-11-3	Dimethylphthalate	20	U
208-96-8	Acenaphthylene	20	U
99-09-2	3-Nitroaniline	120	U
83-32-9	Acenaphthene	20	U
51-28-5	2,4-Dinitrophenol	200	U
100-02-7	4-Nitrophenol	100	U
132-64-9	Dibenzofuran	20	U
606-20-2	2,6-Dinitrotoluene	100	U

FORM-1

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS

Sample No: **COS-SAMOA DILUTION**

Lab Sample ID: Z300A-DL
LIMS ID: 98-24231
Matrix: Water
Data Release Authorized: Mn
Reported: 12/07/98

QC Report No: Z300-CH2M Hill, Incorporated
Project: Chicken of the Sea- effluent
Date Sampled: 11/19/98
Date Received: 11/23/98

Date extracted: 11/23/98
Date analyzed: 12/02/98
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:20

CAS Number	Analyte	ug/L
121-14-2	2,4-Dinitrotoluene	100 U
84-66-2	Diethylphthalate	20 U
7005-72-3	4-Chlorophenyl-phenylether	20 U
86-73-7	Fluorene	20 U
100-01-6	4-Nitroaniline	100 U
534-52-1	4,6-Dinitro-2-Methylphenol	200 U
86-30-6	N-Nitrosodiphenylamine	20 U
101-55-3	4-Bromophenyl-phenylether	20 U
118-74-1	Hexachlorobenzene	20 U
87-86-5	Pentachlorophenol	100 U
85-01-8	Phenanthrene	20 U
86-74-8	Carbazole	20 U
120-12-7	Anthracene	20 U
84-74-2	Di-n-Butylphthalate	20 U
206-44-0	Fluoranthene	20 U
129-00-0	Pyrene	20 U
85-68-7	Butylbenzylphthalate	20 U
91-94-1	3,3'-Dichlorobenzidine	100 U
56-55-3	Benzo(a)anthracene	20 U
117-81-7	**bis(2-Ethylhexyl)phthalate**	**79**
218-01-9	Chrysene	20 U
117-84-0	Di-n-Octyl phthalate	20 U
205-99-2	Benzo(b)fluoranthene	20 U
207-08-9	Benzo(k)fluoranthene	20 U
50-32-8	Benzo(a)pyrene	20 U
193-39-5	Indeno(1,2,3-cd)pyrene	20 U
53-70-3	Dibenz(a,h)anthracene	20 U
191-24-2	Benzo(g,h,i)perylene	20 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	72.8%	d5-Phenol	68.8%
2-Fluorobiphenyl	60.8%	2-Fluorophenol	90.7%
d14-p-Terphenyl	64.0%	2,4,6-Tribromophenol	94.9%
d4-1,2-Dichlorobenzene	74.4%	d4-2-Chlorophenol	77.9%

FORM-1

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS

Sample No: Method Blank

Lab Sample ID: Z300MB
LIMS ID: 98-24231
Matrix: Water
Data Release Authorized:
Reported: 12/07/98

QC Report No: Z300-CH2M Hill, Incorporated
Project: Chicken of the Sea- effluent
Date Sampled: NA
Date Received: NA

Date extracted: 11/23/98
Date analyzed: 12/01/98
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:1

CAS Number	Analyte	ug/L
108-95-2	Phenol	2.0 U
111-44-4	Bis-(2-Chloroethyl) Ether	2.0 U
95-57-8	2-Chlorophenol	1.0 U
541-73-1	1,3-Dichlorobenzene	1.0 U
106-46-7	1,4-Dichlorobenzene	1.0 U
100-51-6	Benzyl Alcohol	5.0 U
95-50-1	1,2-Dichlorobenzene	1.0 U
95-48-7	2-Methylphenol	2.0 U
108-60-1	2,2'-Oxybis(1-Chloropropane)	1.0 U
106-44-5	4-Methylphenol	1.0 U
621-64-7	N-Nitroso-Di-N-Propylamine	2.0 U
67-72-1	Hexachloroethane	2.0 U
98-95-3	Nitrobenzene	1.0 U
78-59-1	Isophorone	1.0 U
88-75-5	2-Nitrophenol	5.0 U
105-67-9	2,4-Dimethylphenol	3.0 U
65-85-0	Benzoic Acid	10 U
111-91-1	bis(2-Chloroethoxy) Methane	1.0 U
120-83-2	2,4-Dichlorophenol	3.0 U
120-82-1	1,2,4-Trichlorobenzene	1.0 U
91-20-3	Naphthalene	1.0 U
106-47-8	4-Chloroaniline	3.0 U
87-68-3	Hexachlorobutadiene	2.0 U
59-50-7	4-Chloro-3-methylphenol	2.0 U
91-57-6	2-Methylnaphthalene	1.0 U
77-47-4	Hexachlorocyclopentadiene	5.0 U
88-06-2	2,4,6-Trichlorophenol	5.0 U
95-95-4	2,4,5-Trichlorophenol	5.0 U
91-58-7	2-Chloronaphthalene	1.0 U
88-74-4	2-Nitroaniline	5.0 U
131-11-3	Dimethylphthalate	1.0 U
208-96-8	Acenaphthylene	1.0 U
99-09-2	3-Nitroaniline	6.0 U
83-32-9	Acenaphthene	1.0 U
51-28-5	2,4-Dinitrophenol	10 U
100-02-7	4-Nitrophenol	5.0 U
132-64-9	Dibenzofuran	1.0 U
606-20-2	2,6-Dinitrotoluene	5.0 U

FORM-1

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS

Sample No: Method Blank

Lab Sample ID: Z300MB
LIMS ID: 98-24231
Matrix: Water
Data Release Authorized: Mr
Reported: 12/07/98

QC Report No: Z300-CH2M Hill, Incorporated
Project: Chicken of the Sea- effluent

Date Sampled: NA
Date Received: NA

Date extracted: 11/23/98
Date analyzed: 12/01/98
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:1

CAS Number	Analyte	ug/L
121-14-2	2,4-Dinitrotoluene	5.0 U
84-66-2	Diethylphthalate	1.0 U
7005-72-3	4-Chlorophenyl-phenylether	1.0 U
86-73-7	Fluorene	1.0 U
100-01-6	4-Nitroaniline	5.0 U
534-52-1	4,6-Dinitro-2-Methylphenol	10 U
86-30-6	N-Nitrosodiphenylamine	1.0 U
101-55-3	4-Bromophenyl-phenylether	1.0 U
118-74-1	Hexachlorobenzene	1.0 U
87-86-5	Pentachlorophenol	5.0 U
85-01-8	Phenanthrene	1.0 U
86-74-8	Carbazole	1.0 U
120-12-7	Anthracene	1.0 U
84-74-2	Di-n-Butylphthalate	1.0 U
206-44-0	Fluoranthene	1.0 U
129-00-0	Pyrene	1.0 U
85-68-7	Butylbenzylphthalate	1.0 U
91-94-1	3,3'-Dichlorobenzidine	5.0 U
56-55-3	Benzo(a)anthracene	1.0 U
117-81-7	bis(2-Ethylhexyl)phthalate	1.0 U
218-01-9	Chrysene	1.0 U
117-84-0	Di-n-Octyl phthalate	1.0 U
205-99-2	Benzo(b)fluoranthene	1.0 U
207-08-9	Benzo(k)fluoranthene	1.0 U
50-32-8	Benzo(a)pyrene	1.0 U
193-39-5	Indeno(1,2,3-cd)pyrene	1.0 U
53-70-3	Dibenz(a,h)anthracene	1.0 U
191-24-2	Benzo(g,h,i)perylene	1.0 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	77.0%	d5-Phenol	64.6%
2-Fluorobiphenyl	61.5%	2-Fluorophenol	84.2%
d14-p-Terphenyl	80.5%	2,4,6-Tribromophenol	85.3%
d4-1,2-Dichlorobenzene	59.2%	d4-2-Chlorophenol	70.3%

FORM-1

ANALYTICAL
RESOURCES
INCORPORATED

WATER SEMIVOLATILE SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: Z300-CH2M Hill, Incorporated
Project: Chicken of the Sea- effluent

Client ID	NBZ	FBP	TPH	PHL	2FP	TBP	2CP	DCB	TOT OUT
Method Blank	77.0%	61.5%	80.5%	64.6%	84.2%	85.3%	70.3%	59.2%	0
Lab Control	78.9%	62.8%	86.0%	74.9%	84.3%	84.2%	77.7%	62.4%	0
Lab Control-DP	73.2%	57.2%	75.8%	67.8%	77.2%	75.1%	70.2%	55.7%	0
COS-SAMOA	110%	74.6%	43.0%	70.5%	135% *	90.2%	96.6%	88.6%	1
COS-SAMOA-DL	72.8%	60.8%	64.0%	68.8%	90.7%	94.9%	77.9%	74.4%	0

LIQUID-LIQUID SW3520B

		LCS/MB LIMITS	QC LIMITS
(NBZ)	= Nitrobenzene-d5	(49-109)	(43-110)
(FBP)	= 2-Fluorobiphenyl	(46-100)	(45-103)
(TPH)	= p-Terphenyl-d14	(50-134)	(29-145)
(PHL)	= Phenol-d5	(26-119)	(32-116)
(2FP)	= 2-Fluorophenol	(42-109)	(38-106)
(TBP)	= 2,4,6-Tribromophenol	(44-120)	(45-129)
(2CP)	= 2-Chlorophenol-d4	(54-108)	(48-108)
(DCB)	= 1,2-Dichlorobenzene-d4	(36-100)	(35-100)

Column to be used to flag recovery values

* Values outside of required QC limits

D Surrogate Compound diluted out

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 1

Lab Sample ID: Z300LCS
LIMS ID: 98-24231
Matrix: Water

QC Report No: Z300-CH2M Hill, Incorporated
Project: Chicken of the Sea- effluent

Data Release Authorized: Mw
Reported: 12/07/98

LCS/LCS DUPLICATE RECOVERY
Date extracted: 11/23/98
Date analyzed: 12/01/98

	SPIKE VALUE	SPIKE ADDED	% RECOVERY	RPD
Phenol	30.1	37.5	80.3%	
2-Chlorophenol	31.9	37.5	85.1%	
1,4-Dichlorobenzene	15.3	25.0	61.2%	
N-Nitroso-Di-N-Propylamine	16.0	25.0	64.0%	
1,2,4-Trichlorobenzene	16.1	25.0	64.4%	
4-Chloro-3-methylphenol	29.4	37.5	78.4%	
Acenaphthene	21.4	25.0	85.6%	
4-Nitrophenol	42.8	37.5	114%	
2,4-Dinitrotoluene	21.9	25.0	87.6%	
Pentachlorophenol	22.0	37.5	58.7%	
Pyrene	23.4	25.0	93.6%	
LCS DUPLICATE				
Phenol	26.5	37.5	70.7%	13.0%
2-Chlorophenol	29.0	37.5	77.3%	9.5%
1,4-Dichlorobenzene	14.8	25.0	59.2%	3.3%
N-Nitroso-Di-N-Propylamine	14.4	25.0	57.6%	11.0%
1,2,4-Trichlorobenzene	15.7	25.0	62.8%	2.5%
4-Chloro-3-methylphenol	26.0	37.5	69.3%	12.0%
Acenaphthene	19.2	25.0	76.8%	11.0%
4-Nitrophenol	43.0	37.5	115%	0.5%
2,4-Dinitrotoluene	19.1	25.0	76.4%	14.0%
Pentachlorophenol	17.8	37.5	47.5%	21.0%
Pyrene	19.9	25.0	79.6%	16.0%

Lab Control Surrogate Recoveries

d5-Nitrobenzene	78.9%	d5-Phenol	74.9%
2-Fluorobiphenyl	62.8%	2-Fluorophenol	84.3%
d14-p-Terphenyl	86.0%	2,4,6-Tribromophenol	84.2%
d4-1,2-Dichlorobenzene	62.4%	d4-2-Chlorophenol	77.7%

LCSDuplicate Surrogate Recoveries

d5-Nitrobenzene	73.2%	d5-Phenol	67.8%
2-Fluorobiphenyl	57.2%	2-Fluorophenol	77.2%
d14-p-Terphenyl	75.8%	2,4,6-Tribromophenol	75.1%
d4-1,2-Dichlorobenzene	55.7%	d4-2-Chlorophenol	70.2%

Reported in Total ug/L

FORM-III

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample No: COS-SAMOA

Lab Sample ID: Z300A
LIMS ID: 98-24231
Matrix: Water

QC Report No: Z300-CH2M Hill, Incorporated
Project: Chicken of the Sea- effluent

Date Sampled: 11/19/98
Date Received: 11/23/98

Data Release Authorized:
Reported: 12/09/98

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
7060	12/01/98	7060	12/07/98	**7440-38-2**	**Arsenic**	0.002	**0.018**
3010	12/01/98	6010	12/07/98	**7440-43-9**	**Cadmium**	0.002	**0.003**
3010	12/01/98	6010	12/07/98	7440-47-3	Chromium	0.005	0.005 U
3010	12/01/98	6010	12/07/98	**7440-50-8**	**Copper**	0.002	**0.012**
3020	12/01/98	7421	12/04/98	**7439-92-1**	**Lead**	0.001	**0.002**
7470	12/01/98	7470	12/03/98	7439-97-6	Mercury	0.0001	0.0001 U
7740	12/01/98	7740	12/04/98	**7782-49-2**	**Selenium**	0.005	**0.007**
3020	12/01/98	7761	12/03/98	7440-22-4	Silver	0.0002	0.0002 U
3010	12/01/98	6010	12/07/98	**7440-66-6**	**Zinc**	0.004	**0.585**

U Analyte undetected at given RL

RL Reporting Limit

FORM-I

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample No: Method Blank

Lab Sample ID: Z300MB
LIMS ID: 98-24231
Matrix: Water

QC Report No: Z300-CH2M Hill, Incorporated
Project: Chicken of the Sea- effluent

Date Sampled: NA
Date Received: NA

Data Release Authorized:
Reported: 12/09/98

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L	
7060	12/01/98	7060	12/07/98	7440-38-2	Arsenic	0.001	0.001	U
3010	12/01/98	6010	12/07/98	7440-43-9	Cadmium	0.002	0.002	U
3010	12/01/98	6010	12/07/98	7440-47-3	Chromium	0.005	0.005	U
3010	12/01/98	6010	12/07/98	7440-50-8	Copper	0.002	0.002	U
3020	12/01/98	7421	12/04/98	7439-92-1	Lead	0.001	0.001	U
7470	12/01/98	7470	12/03/98	7439-97-6	Mercury	0.0001	0.0001	U
7740	12/01/98	7740	12/04/98	7782-49-2	Selenium	0.001	0.001	U
3020	12/01/98	7761	12/03/98	7440-22-4	Silver	0.0002	0.0002	U
3010	12/01/98	6010	12/07/98	**7440-66-6**	**Zinc**	0.004	**0.004**	

U Analyte undetected at given RL

RL Reporting Limit

FORM-I

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Lab Sample ID: Z300LCS
LIMS ID: 98-24231
Matrix: Water

QC Report No: Z300-CH2M Hill, Incorporated
Project: Chicken of the Sea- effluent

Data Release Authorized:
Reported: 12/09/98

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Spike mg/L	Spike Added	% Recovery	Q
Arsenic	0.039	0.040	97.5%	
Cadmium	0.045	0.050	90.0%	
Chromium	0.200	0.200	100%	
Copper	0.257	0.250	103%	
Lead	0.022	0.020	110%	
Mercury	0.0020	0.0020	100%	
Selenium	0.009	0.010	90.0%	
Silver	0.019	0.020	95.0%	
Zinc	0.504	0.500	101%	

'Q' codes: N = control limit not met

Control Limits: 80-120%

FORM-VII

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample No: COS-SAMOA

Lab Sample ID: Z300A
LIMS ID: 98-24231
Matrix: Water

QC Report No: Z300-CH2M Hill, Incorporated
Project: Chicken of the Sea- effluent

Date Sampled: 11/19/98
Date Received: 11/23/98

Data Release Authorized:
Reported: 12/09/98

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
7060	12/01/98	7060	12/07/98	**7440-38-2**	**Arsenic**	0.002	**0.018**
3010	12/01/98	6010	12/07/98	**7440-43-9**	**Cadmium**	0.002	**0.003**
3010	12/01/98	6010	12/07/98	7440-47-3	Chromium	0.005	0.005 U
3010	12/01/98	6010	12/07/98	**7440-50-8**	**Copper**	0.002	**0.012**
3020	12/01/98	7421	12/04/98	**7439-92-1**	**Lead**	0.001	**0.002**
7470	12/01/98	7470	12/03/98	7439-97-6	Mercury	0.0001	0.0001 U
7740	12/01/98	7740	12/04/98	**7782-49-2**	**Selenium**	0.005	**0.007**
3020	12/01/98	7761	12/03/98	7440-22-4	Silver	0.0002	0.0002 U
3010	12/01/98	6010	12/07/98	**7440-66-6**	**Zinc**	0.004	**0.585**

U Analyte undetected at given RL

RL Reporting Limit

FORM-I

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample No: Method Blank

Lab Sample ID: Z300MB
LIMS ID: 98-24231
Matrix: Water

QC Report No: Z300-CH2M Hill, Incorporated
Project: Chicken of the Sea- effluent

Date Sampled: NA
Date Received: NA

Data Release Authorized:
Reported: 12/09/98

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
7060	12/01/98	7060	12/07/98	7440-38-2	Arsenic	0.001	0.001 U
3010	12/01/98	6010	12/07/98	7440-43-9	Cadmium	0.002	0.002 U
3010	12/01/98	6010	12/07/98	7440-47-3	Chromium	0.005	0.005 U
3010	12/01/98	6010	12/07/98	7440-50-8	Copper	0.002	0.002 U
3020	12/01/98	7421	12/04/98	7439-92-1	Lead	0.001	0.001 U
7470	12/01/98	7470	12/03/98	7439-97-6	Mercury	0.0001	0.0001 U
7740	12/01/98	7740	12/04/98	7782-49-2	Selenium	0.001	0.001 U
3020	12/01/98	7761	12/03/98	7440-22-4	Silver	0.0002	0.0002 U
3010	12/01/98	6010	12/07/98	**7440-66-6**	**Zinc**	0.004	**0.004**

U Analyte undetected at given RL

RL Reporting Limit

FORM-I

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

ANALYTICAL RESOURCES INCORPORATED

Lab Sample ID: Z300LCS
LIMS ID: 98-24231
Matrix: Water

QC Report No: Z300-CH2M Hill, Incorporated
Project: Chicken of the Sea- effluent

Data Release Authorized:
Reported: 12/09/98

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Spike mg/L	Spike Added	% Recovery	Q
Arsenic	0.039	0.040	97.5%	
Cadmium	0.045	0.050	90.0%	
Chromium	0.200	0.200	100%	
Copper	0.257	0.250	103%	
Lead	0.022	0.020	110%	
Mercury	0.0020	0.0020	100%	
Selenium	0.009	0.010	90.0%	
Silver	0.019	0.020	95.0%	
Zinc	0.504	0.500	101%	

'Q' codes: N = control limit not met

Control Limits: 80-120%

FORM-VII

ANALYTICAL
RESOURCES
INCORPORATED

Final Report
Laboratory Analysis of Conventional Parameters

Sample No: COS-SAMOA

Lab Sample ID: Z300A
LIMS ID: 98-24231
Matrix: Water

QC Report No: Z300-CH2M Hill, Incorporated
Project: Chicken of the Sea- effluent

Date Sampled: 11/19/98
Date Received: 11/23/98

Data Release Authorized: MP
Reported: 12/08/98 Dr. M.A. Perkins

Analyte	Analysis Date & Batch	Method	RL	Units	Result
Phenol	12/01/98 120198#1	EPA 420.1	0.04	mg/L	0.06

RL Analytical reporting limit
U Undetected at reported detection limit

Report for Z300 received 11/23/98

ANALYTICAL
RESOURCES
INCORPORATED

QA Report - Method Blank Analysis

QC Report No: Z300-CH2M Hill, Incorporated
Project: Chicken of the Sea- effluent

Matrix: Water

Date Received: NA

Data Release Authorized: MAP
Reported: 12/08/98 Dr. M.A. Perkins

METHOD BLANK RESULTS
CONVENTIONALS

Analysis Date & Batch	Constituent	Units	Result	
12/01/98 120198#1	Phenol	mg/L	< 0.04	U

ANALYTICAL
RESOURCES
INCORPORATED

QA Report - Laboratory Control Samples

QC Report No: Z300-CH2M Hill, Incorporated
Project: Chicken of the Sea- effluent

Date Received: NA

Data Release Authorized:
Reported: 12/08/98 Dr. M.A. Perkins

LABORATORY CONTROL SAMPLES
CONVENTIONALS

Constituent	Units	Measured Value	True Value	Recovery
Laboratory Control Sample				
Phenol	mg/L	0.10	0.13	76.9%

Date analyzed: 12/01/98 Batch ID: 120198#1

QA Report - Standard Reference Material Analysis

QC Report No: Z300-CH2M Hill, Incorporated
Project: Chicken of the Sea- effluent

Date Received: NA

Data Release Authorized: MP
Reported: 12/08/98 Dr. M.A. Perkins

STANDARD REFERENCE MATERIAL ANALYSIS
CONVENTIONALS

Constituent	Units	Value	True Value	Recovery
EM #36141630				
Phenol	mg/L	0.13	0.13	100%
Date analyzed: 12/01/98	Batch ID: 120198#1			

ANALYTICAL
RESOURCES
INCORPORATED

QA Report - Replicate Analysis

QC Report No: Z300-CH2M Hill, Incorporated
Project: Chicken of the Sea- effluent

Matrix: Water

Date Received: 11/23/98

Data Release Authorized:
Reported: 12/08/98 Dr. M.A. Perkins

DUPLICATE ANALYSIS RESULTS
CONVENTIONALS

Constituent	Units	Sample Value	Duplicate Value	RPD
ARI ID: 98-24231, Z300 A	**Client Sample ID: COS-SAMOA**			
Phenol	mg/L	0.06	0.05	18.2%

TECHNICAL MEMORANDUM

PREPARED FOR:	StarKist Samoa, Inc. Chicken of the Sea (COS) Samoa Packing Company, Inc.
PREPARED BY:	Steve Costa and Karen Glatzel/gdc David Wilson/CH2M HILL/SEA
DATE:	20 December 1998
SUBJECT:	**Bioassay Testing of Effluent June 1998 Sampling**
PROJECT:	147323.JC.EM

Purpose

This memorandum presents the results of the bioassay testing of the Joint Cannery Outfall effluent sample that was collected in June 1998. This is the eleventh required semi-annual test. Separate technical memoranda are being prepared to describe the results of concurrent effluent chemistry testing.

Study Objectives

Section D.1 of the StarKist Samoa and COS Samoa Packing NPDES permits requires that semi-annual definitive acute bioassays (96-hour static bioassays) be conducted on the cannery effluent. The purpose of these bioassays is to determine whether, and at what effluent concentration, acute toxicity may be detected for the effluent.

U.S. EPA has conducted a number of reviews of the effluent sampling, analysis, and bioassay tests. All comments from U.S. EPA have been incorporated into either the Standard Operating Procedures or have been incorporated into the procedures by the laboratory doing the test, Advanced Biological Testing, Inc., as documented in previous reports.

The bioassays were originally specified to be conducted using the white shrimp, *Penaeus vannami* (postlarvae). In the event *Penaeus vannami* is not available at the time of the tests, a substitute species, *Mysidopsis bahia*, has been approved by U.S. EPA (CH2M HILL, 26 January 1995). For the June 1998 sampling, *Penaeus vannami* was not available and *Mysidopsis bahia* was used.

The acute bioassay effluent sampling must be concurrent with effluent sampling for chemical analysis. Effluent samples are to be collected as 24-hour composite samples. The effluent acute bioassay was conducted using a combined composite effluent sample made up from the composite effluent samples from the StarKist Samoa and COS Samoa Packing facilities, as approved by EPA. This combined effluent bioassay is representative of the wastewater discharged from the joint cannery outfall to Pago Pago Harbor.

Effluent Sampling Methods

Between 1200 on 25 June 1998 and 0900 on 26 June 1998, 24-hour, flow-weighted, composite samples of final effluent were collected from both the StarKist Samoa and COS Samoa Packing effluent discharges. Samples were collected from the established effluent sampling sites following the routine composite sample collection schedule for the plants. Detailed sampling procedures are described in the technical memorandum presenting the March 1995 effluent bioassay sampling.

A total of eight grab samples were collected into pre-cleaned 1-gallon plastic cubitainers at each plant. Samples were collected at approximately three-hour intervals over a 24 hour period. The samples were stored on ice until the completion of the 24-hour sampling period. After all samples were collected a flow-proportioned composite sample was prepared. The grab sample collection times and the relative effluent volumes calculated from plant flow records are summarized in Table 1. The relative effluent volumes were used to prepare the final composite sample, which was used to fill the sample container shipped to the laboratory for testing.

A 5-gallon cubitainer containing the composite sample was packed on ice in an ice chest for shipment to the laboratory. A chain-of-custody form for the sample was completed and then sealed into a zip-lock bag and taped inside the lid of the ice chest. The sample was shipped via DHL on flights from Pago Pago to Honolulu and then to San Francisco. Samples were received by the testing laboratory on 29 June 1998. The chain-of-custody form is provided in Attachment I.

Bioassay Testing Procedures

The bioassay test was conducted by Advanced Biological Testing Inc., Rohnert Park, California. The testing procedures and results of the bioassay tests are provided in "*Results of a Bioassay Conducted on an Effluent Sample from the Joint Cannery Outfall in American Samoa Using Mysidopsis bahia*" dated 16 July 1998 included as Attachment II. This report summarizes the 96-hour acute bioassay test conducted with reference to U.S. EPA document *EPA/600/4-90/027F*, August 1993, as the source of methods for conducting the test.

The bioassay test was conducted considering and including U.S. EPA's comments on previous bioassay tests, as documented in previous reports. A brine control was run and a comparison was made with the dilution water "laboratory control". The test organisms were required to be 1 to 5 days old, with a 24-hour range in age, and the test temperature was to be held at 20 ±1°C or 25 ±1°C. For this bioassay, three day old *Mysidopsis bahia* were used since penaeids were not available. Test organisms were tested at 25 ±2°C. Because of the demonstrated potential for a lethal immediate dissolved oxygen demand (IDOD), discussed and documented in previous technical memoranda describing the first two bioassay tests, each bioassay test chamber was continuously aerated during the bioassay tests to maintain adequate levels of dissolved oxygen (DO). Bioassay tests were carried out for effluent concentrations of 50, 25, 12.5, 6.25, and 3.1% as vol:vol dilutions in seawater. Water quality was monitored daily and parameters measured included DO, pH, salinity, temperature, and ammonia. Additionally, a reference toxicant of sodium dodecyl sulfonate (SDS) was made up of a 2-gram per liter stock solution in distilled water and tested at concentrations of 25, 12.5, 6.25, 3.1, and 1.9 mg/L in 31 ppt seawater for a 96-hour test.

Results

The results of the bioassay tests are summarized as follows:

> ***Mysidopsis bahia* Effluent Bioassay.** All results from the bioassay tests are included in Attachment II. The results of the mysid bioassay tests indicate the LC_{50} for the effluent tested was 17.2 percent. The No Observable Effects Concentration (NOEC) for the 96-hour bioassay was 6.25 percent and the Least Observable Effects Concentration (LOEC) was 12.5 percent. The calculated value of toxicity units (TU) was 16.
>
> ***Mysidopsis bahia* Reference Toxicant Bioassay.** The reference toxicant had a LC_{50} of 13.2 mg/l. The laboratory mean was 15.27 ± 5.06 mg/l with the data falling within one standard deviation of the laboratory mean, indicating normal sensitivity.

Discussion

Table 2 summarizes the results of the effluent bioassay tests for the samples collected in the June 1998 sampling compared to the previous bioassay tests. The LC_{50}, NOEC and LOEC are within the range obtained from previous reports where *Mysidopsis bahia* was used in place of *Penaeus vannami*.

Conclusions

The bioassay tests for the Joint Cannery Outfall effluent for June 1998 do not indicate effluent toxicity levels to be of concern. As discussed in the previous bioassay test reports on the effluent, the time scale of the mixing of the effluent with the receiving water is on the order of minutes to seconds to achieve dilutions that will eliminate possible toxic effects as reflected by the bioassay results. For example, an NOEC of 6.25% which was observed in June 1998, corresponds to a dilution of 16:1 which is achieved within a time frame of seconds and within a few meters of the discharge point. The discharge is located in about 180 feet of water and the effluent toxicity tests indicate that the discharge is diluted to non-toxic levels immediately after discharge and well within the initial dilution plume.

Table 1
StarKist Samoa and COS Samoa Packing 24-hour Composite Effluent Sample for Bioassay Testing
25-26 June 1998

Grab Sample Number	COS Samoa Packing		StarKist Samoa		COS Samoa Packing Percent of Total Flow	StarKist Samoa Percent of Total Flow
	Sampling Date and Time	Effluent Flow Rate (mgd)	Sampling Date and Time	Effluent Flow Rate (mgd)		
	06/25/98		06/25/98			
1	1200	0.96	1200	1.26	5.4	7.1
2	1500	0.82	1500	1.30	4.6	7.3
3	1800	0.98	1800	1.25	5.5	7.0
4	2100	1.04	2100	1.20	5.9	6.8
5	2400	1.04	2400	1.32	5.9	7.4
	06/26/98		06/26/98			
6	0300	1.00	0300	1.08	5.6	6.1
7	0600	0.96	0600	1.33	5.4	7.5
8	0900	0.88	0900	1.33	5.0	7.5
Total		7.68		10.07	43.3	56.7
Mean		0.96		1.26		

Table 2
StarKist Samoa and COS Samoa Packing
Combined Effluent Bioassay Results

Date	Species	Parameters		
		LC 50	NOEC	LOEC
2/93	*Penaeus vannami*	4.8%[1]	3.1%	6.25%
10/93	*Penaeus vannami*	15.67%	3.1%	6.25%
2/94	*Penaeus vannami*	15.76%	<1.6%	1.6%
10/94	***Mysidopsis bahia*[2]**	**31.2%**	**25%**	**50%**
3/95	*Penaeus vannami*	14.8%	6.25%	12.5%
3/95	***Mysidopsis bahia*[3]**	**10.8%**	**6.25%**	**12.5%**
2/96	*Penaeus vannami*	>50%	>50%	>50%
2/96	***Mysidopsis bahia*[3]**	**28.36%**	**12.5%**	**25%**
3/96	*Penaeus vannami*	44.4%	25%	50%
11/96	*Penaeus vannami*	7.11%	3.1%	6.25%
03/97	*Penaeus vannami*	39.36%	12.5%	25%
09/97	*Penaeus vannami*[4]	12.3%	6.25%	12.5%
06/98	***Mysidopsis bahia*[2]**	**17.2%**	**6.25%**	**12.5%**

[1]The February 1993 samples were not aerated until after the first day of the test. For subsequent tests the samples were aerated for the entire duration of the tests.
[2]*Mysidopsis bahia* substitutes as *Penaeus vannami* not available, as directed by U. S. EPA.
[3]*Mysidopsis bahia* used in addition to *Penaeus vannami* as described in text. Only one species is required by the permit conditions.
[4]Stage 1 (3 mm) *Penaeus vannami* were used for testing as older Stage 7 and 8 (8-10 mm) *Penaeus vannami* were not available.

ATTACHMENT I

CHAIN-OF-CUSTODY FORM

JOINT CANNERY OUTFALL EFFLUENT SAMPLE
26 June 1998

CH2MHILL Analytical Services
CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

[ ] LMG 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-1444 FAX (334) 271-3428
[ ] LRD 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244-4109
[ ] LKW Canviro Analytical Laboratories, Inc. 50 Bathurst, Unit 12, Waterloo, Ontario, Canada N2V 2C5, (519) 747-2575 FAX (519) 747-3806
[ ] CVO 2300 NW Walnut Boulevard, Corvallis, OR 97330-3638, (541) 752-4271 FAX (541) 752-0276

COC #

Project #: 147323 JC.EM
Purchase Order #:
Project Name: JOINT CANNERY OUTFALL-NPDES
Company Name: SAMOA PACKING/STAR KIST SAMOA
Project Manager or Contact & Phone #: Steve Costa 707-[illegible]
Report Copy to:
Requested Completion Date:
Site ID:
Sample Disposal: Dispose [ ] Return [ ]

Requested Analytical Method #: 96 Hour Acute BIOASSAY (2) (RENALDS)
Preservative: NONE

THIS AREA FOR LAB USE ONLY: Lab # / Page of / Lab PM / Custody Review / Log In / LIMS Verification / pH / Custody Seals Y N / Ice Y N / QC Level 1 2 3 Other / Cooler Temperature

Sampling Date	Time	Type COMP	GRAB	Matrix WATER	SOIL	AIR	CLIENT SAMPLE ID (9 CHARACTERS)	LAB QC	TOTAL # OF CONTAINERS	Requested Analytical Method	Alternate Description	Lab ID
6/24/9[illegible]		X		X			JCO-BA		1	X		

Relinquished By	Empty Bottles	Date/Time	Received By	Empty Bottles	Date/Time
Sampled By and Title (Please sign and print name): LESINA SUATIA		6/24/9[illegible]	Relinquished By (Please sign and print name): LESINA SUATIA		6/24/9[illegible]
Received By (Please sign and print name)		Date/Time	Relinquished By (Please sign and print name)		Date/Time
Received By (Please sign and print name)		Date/Time	Shipped Via UPS Fed-Ex Other	Shipping #: DHL	

Special Instructions:

Instructions and Agreement Provisions on Reverse Side

ATTACHMENT II

LABORATORY REPORT
Advanced Biological Testing
96-hour Acute Bioassay

JOINT CANNERY OUTFALL EFFLUENT SAMPLE
26 June 1998

RESULTS OF BIOASSAYS CONDUCTED ON AN EFFLUENT SAMPLE FROM THE JOINT CANNERY OUTFALL IN AMERICAN SAMOA Using *Mysidopsis bahia*

Prepared for:

CH2M Hill California, Inc.
1111 Broadway
Oakland, CA 94607
Project # 107091.EL.97

Prepared by:

Advanced Biological Testing Inc.
5685 Redwood Drive, Suite 105
Rohnert Park, CA 94928

July 16, 1998

Ref: 9824

1.0
INTRODUCTION

At the request of CH2M Hill (Project # PDX 30702), Advanced Biological Testing conducted a four day effluent bioassay test on Mysidopsis bahia using effluents collected from the joint cannery outsell at the Starkest and Van Camp tuna canneries in American Samoa. The studies were run using methods generally specified in EPA 1991. Penaeus is the preferred species according to the NPDES permit, however when Penaeus are unavailable, Mysidopsis has been substituted. Penaeus was not available to start this test and Mysidopsis was used instead.

The study was conducted at the Advanced Biological Testing Laboratory in Rohnert Park, California, and was managed by Mr. Mark Fisler.

2.0 METHODS

2.1 Effluent Sampling

The effluents were sampled on June 26, 1998 by cannery personnel under the supervision of CH2M Hill. The sample was received by the laboratory on June 29, 1998. One five gallon carboy was provided and maintained in an ice-filled cooler from the date of sampling until laboratory receipt. The sample was at 5°C upon receipt.

2.2 Sample Preparation

The salinity of the effluent sample was 14 ppt and required salinity adjustment to 30 ppt. The effluent salinity was increased to 30 ppt with 100 ppt natural seawater brine. The brine was made from frozen Bodega Bay seawater. Due to the dilution of the effluent with the brine solution, the initial maximum concentration of effluent was 80%. The highest initial test concentration was made by diluting the 80% effluent with Bodega Bay seawater to an actual effluent concentration of 50%. The dissolved oxygen level in the sample was low. The initial total ammonia was approximately 6 ppm (2.98 ppm in the 50% test sample).

The effluents were tested at an actual effluent concentration series of 50%, 25%, 12.5%, 6.25%, and 3.1% as vol:vol dilution in seawater. A brine control was run with the test to assess the potential toxicity from the added brine. The diluent and the control water was filtered seawater from Bodega Bay. The dilutions were brought to the test temperature (20 ± 2°C) and aerated continuously. Based upon the previous testing, these effluents have an increasing biological oxygen demand, with a significant peak at 10-14 hours after test initiation. Previous testing of this effluent conducted without initial aeration demonstrated significant toxicity at 24 hours (or before); therefore aeration was carried out from the beginning of the test. According to EPA methods the test chambers were renewed with retained effluents held under refrigeration from test initiation on Day 2.

A reference toxicant was run using concentrations initially provided by the EPA. The toxicant was sodium dodecyl sulfonate (SDS) made up as a 2 grams per liter stock solution in distilled water. The tested concentrations were set at 25, 12.5, 6.25, 3.1, and 1.9 mg/L in 31 ppt seawater.

2.3 TESTING PROCEDURES

The bioassays were carried out on three day old larvae of Mysidopsis bahia supplied by Aquatox in Arkansas. The mysids were received on June 30, 1998 and were used immediately. Five replicates of each concentration were tested with ten animals per replicate. Water quality was monitored daily as initial quality on Day 0 and final water quality on Days 1-4. Parameters measured included dissolved oxygen, pH, salinity, total ammonia, and temperature.

2.4 STATISTICAL ANALYSIS

At the conclusion of the test, the survival data were evaluated statistically using ToxCalc™ to determine ECp, NOEC, and LOEC values where appropriate. ToxCalc™ is a comprehensive statistical application that follows standard guidelines for acute toxicity data analysis. Statistical effects can be measured by the ECp, the estimated concentration that causes any effect, either lethal (LC) or sublethal (IC), on p% of the test population. The LCp is the point estimate of the concentration at which a lethal effect is observed in p% of the test organisms. ECp values include 95% confidence limits if calculable.

3.0 RESULTS

3.1 INTRODUCTION

Tables 1 through 6 present the results of the Mysidopsis testing. The test conditions are summarized in Table 1. In the test, water quality measurements were within the acceptable limits provided in EPA 1991. Temperature was maintained at 25 ± 2°C; the pH remained relatively stable, and the salinity increased very slightly as would be expected in a static test (Tables 2 and 3). Aeration was maintained in all chambers for the duration of the test. The test solutions were renewed with reserved effluent at 48 hrs.

Initial ammonia was 1.75 ppm in the 50% effluent and was proportionally diluted at lower percentage concentrations. The LC50 for the effluent was 17.2% (95% confidence limits = 15% to 21%). There was significant mortality at the 12.5%, 25% and 50% concentrations compared to the control (Table 4). The NOEC was 6.25%, and the LOEC was 12.5%. The TU was 16.

The reference toxicant test had an LC50 of 13.2 mg/L (Tables 5 and 6). The laboratory mean for *Mysidopsis bahia* was 15.27 mg/L (SD = 5.06 mg/L). The data is within one standard deviation of the laboratory mean, indicating normal sensitivity.

TABLE 1

Bioassay Procedure And Organism Data For the Survival Bioassay Using *Mysidopsis bahia* (U.S. EPA 1991)

Parameter	Data
Sample Identification	
Sample ID(s)	9806329-1
Date Sampled	6/26/98
Date Received at ABT	6/29/98
Volume Received	Five gallons
Sample Storage Conditions	4°C in the dark
Test Species	*Mysidopsis bahia*
Supplier	Aquatox, Hot Springs, Arkansas
Collection location	In house colony
Date Acquired	6/30/98
Acclimation Time	Used immediately
Acclimation Water	Shipping water
Acclimation Temperature	25±2°C
Age group	Three day old larvae
Test Procedures	
Type; Duration	Acute, static/renewal at 48 hours
Test Dates	6/29/98 to 7/4/98
Control Water	Bodega Bay seawater
Test Temperature	25± 2°C
Test Photoperiod	14 L : 10 D
Salinity	30± 2 ppt
Test Chamber	1000 mL jars
Animals/Replicate	10
Exposure Volume	500 mL
Replicates/Treatment	5
Feeding	Brine shrimp (<24 hr old nauplii)
Deviations from procedures	None

TABLE 2

Mysidopsis bahia
INITIAL WATER QUALITY MEASUREMENTS FOR EFFLUENT TEST
Test Dates: 6/30/98 to 7/4/98

Concentration	Day 0					Day 2				
(%)	pH	DO	NH 3	°C	Sal	pH	DO	NH 3	°C	Sal
Control	7.95	7.7	0.19	20.5	30	8.04	7.3	0.03	20.3	33
Brine	7.98	7.5	0.16	20.4	29	8.07	7.3	0.01	20.2	31
3.1	7.92	7.6	0.19	20.6	30	8.04	7.5	0.17	20.3	34
6.25	7.82	7.5	0.37	20.7	30	8.01	7.3	0.53	19.8	33
12.5	7.64	7.5	0.07	20.7	30	7.97	7.3	0.61	19.5	33
25	7.28	7.1	1.38	20.9	29	7.89	6.7	1.34	18.7	32
50	7.18	6.9	1.75	21.0	29	7.72	6.1	2.50	20.1	31
Min	7.18	6.9	0.07	20.4	29	7.72	6.1	0.01	18.7	31
Max	7.98	7.7	1.75	21.0	30	8.07	7.5	2.50	20.3	34

TABLE 3

Mysidopsis bahia
FINAL WATER QUALITY MEASUREMENTS FOR EFFLUENT TEST

Concentration		Day 1				Day 2				Day 3				Day 4			
(%)	Rep	pH	DO	°C	Sal	pH	DO	°C	Sal	pH	DO	°C	Sal	pH	DO	°C	Sal
Control	**1**	8.37	7.7	19.9	28	8.32	7.5	19.7	31	8.30	7.4	21.2	33	8.19	7.6	21.5	33
	2	8.34	7.7	19.1	30	8.31	7.5	19.9	30	8.29	7.4	21.2	33	8.19	7.6	21.2	33
	3	8.32	7.7	18.9	30	8.31	7.5	19.9	30	8.27	7.4	21.2	33	8.18	7.6	21.1	33
	4	8.33	7.7	18.9	30	8.31	7.5	19.6	30	8.29	7.4	21.1	33	8.18	7.6	21.0	33
	5	8.31	7.7	18.6	30	8.30	7.5	19.4	31	8.28	7.4	21.2	33	8.19	7.6	21.3	33
Brine	**1**	8.35	7.8	18.6	30	8.33	7.5	19.4	30	8.32	7.4	21.2	31	8.22	7.6	21.3	31
Control	**2**	8.35	7.7	18.7	29	8.33	7.6	19.7	30	8.30	7.4	21.1	31	8.21	7.6	21.1	31
	3	8.34	7.7	18.9	29	8.32	7.7	19.9	30	8.30	7.4	21.1	31	8.20	7.6	20.9	31
	4	8.33	7.7	18.7	29	8.32	7.5	19.7	30	8.12	6.2	21.1	31	8.19	7.6	20.9	31
	5	8.31	7.7	18.6	29	8.31	7.5	19.5	30	8.27	7.2	21.2	31	8.19	7.8	21.5	31
3.1	**1**	8.34	7.7	18.5	30	8.33	7.5	19.5	31	8.31	7.2	20.9	32	8.23	7.7	21.4	33
	2	8.33	7.7	18.6	30	8.32	7.6	19.8	30	8.26	7.3	20.9	32	8.21	7.6	21.1	33
	3	8.33	7.8	18.7	30	8.32	7.6	19.8	30	8.29	7.3	20.9	32	8.22	7.6	20.9	33
	4	8.33	7.7	18.6	30	8.32	7.5	19.6	30	8.30	7.3	20.9	32	8.23	7.6	20.9	33
	5	8.34	7.7	18.6	30	8.32	7.5	19.4	30	8.30	7.4	21.1	32	8.22	7.8	21.4	33
6.25	**1**	8.34	7.7	18.2	31	8.34	7.5	19.6	32	8.33	7.2	20.7	33	8.27	7.8	21.6	33
	2	8.33	7.8	18.6	30	8.32	7.5	19.8	30	8.28	7.2	20.7	33	8.25	7.6	21.0	33
	3	8.34	7.9	18.6	30	8.33	7.5	19.6	30	8.31	7.2	20.6	33	8.25	7.6	20.9	33
	4	8.34	7.9	18.6	30	8.32	7.5	19.6	31	8.34	7.3	20.7	33	8.27	7.6	21.0	33
	5	8.34	7.9	18.7	30	8.01	7.5	19.6	30	7.70	6.6	21.2	33	8.12	7.8	21.6	33
12.5	**1**	8.36	7.6	18.8	30	8.36	7.3	19.9	30	8.35	7.3	20.7	33	8.00	5.5	21.7	33
	2	8.28	7.6	18.7	30	8.29	7.3	19.9	30	8.16	7.2	20.6	33	7.89	5.3	21.2	33
	3	8.34	7.6	18.9	30	8.34	7.3	19.8	30	8.30	7.2	20.7	33	7.95	5.3	21.2	33
	4	7.82	7.7	18.9	30	8.39	7.3	19.6	30	—	—	—	—	—	—	—	—
	5	8.23	6.9	18.7	30	8.00	7.3	19.0	30	7.62	6.2	21.2	33	7.68	4.8	21.6	33
25	**1**	8.41	7.4	18.9	30	8.40	6.9	19.9	30	8.35	7.2	20.8	33	8.31	7.4	21.6	33
	2	8.27	7.5	18.9	30	8.26	7.1	20.0	30	—	—	—	—	—	—	—	—
	3	8.37	7.5	18.9	30	8.36	7.1	20.0	30	8.30	7.1	20.9	33	8.33	7.3	21.2	33
	4	8.39	7.5	18.8	30	8.37	7.3	19.6	30	8.30	7.1	21.0	33	8.32	7.4	21.2	33
	5	8.32	7.5	18.7	30	8.33	7.3	19.6	30	8.23	7.2	21.2	33	8.27	7.4	21.4	33
50	**1**	8.36	7.5	18.9	30	8.35	7.3	19.4	31	8.27	7.0	21.2	32	8.39	7.4	21.8	33
	2	8.31	7.5	18.9	30	8.30	7.3	19.4	30	8.19	7.0	21.2	32	8.28	7.4	21.8	33
	3	8.28	7.5	18.9	30	8.29	7.3	19.5	30	—	—	—	—	—	—	—	—
	4	8.31	7.5	18.9	30	8.32	7.3	19.6	30	8.22	6.8	21.7	32	8.36	7.4	21.9	33
	5	8.18	7.5	19.1	30	8.23	7.3	19.7	30	—	—	—	—	—	—	—	—
Min		7.82	6.9	18.2	28	8.00	6.9	19.0	30	7.62	6.2	20.6	31	7.68	4.8	20.9	31
Max		8.41	7.9	19.9	31	8.40	7.7	20.0	32	8.35	7.4	21.7	33	8.39	7.8	21.9	33

Note: — = All animals dead.

TABLE 4

Mysidopsis bahia
SURVIVAL DATA FOR EFFLUENT TEST

Concentration (%)	Rep	Initial Added	Day 1	Day 2	Day 3	Day 4	% Survival	Average % Survival
Control	**1**	10	10	9	9	9	90	
	2	10	10	9	9	9	90	
	3	10	10	10	10	10	100	
	4	10	10	8	8	8	80	
	5	10	10	10	10	10	100	92.0
Brine Control	**1**	10	10	9	9	9	90	
	2	10	10	9	9	9	90	
	3	10	10	9	9	9	90	
	4	10	10	8	8	8	80	
	5	10	10	6	6	6	60	82.0
3.1	**1**	10	10	10	10	10	100	
	2	10	10	9	9	8	80	
	3	10	10	9	8	8	80	
	4	10	10	9	9	9	90	
	5	10	10	10	10	10	100	90.0
6.25	**1**	10	10	10	10	10	100	
	2	10	10	9	9	9	90	
	3	10	10	10	10	10	100	
	4	10	10	10	10	10	100	
	5	10	10	3	3	3	30	84.0
12.5	**1**	10	10	8	*	9	90	
	2	10	10	7	*	5	50	
	3	10	10	7	*	7	70	
	4	10	8	0	*	—	0	
	5	10	10	10	*	0	0	42.0
25	**1**	10	10	6	*	6	60	
	2	10	10	0	—	—	0	
	3	10	10	7	*	5	50	
	4	10	10	8	*	9	0	
	5	10	10	9	*	8	80	38.0
50	**1**	10	10	6	*	0	0	
	2	10	10	7	*	0	0	
	3	10	10	0	—	—	0	
	4	10	10	5	*	0	0	
	5	10	10	0	—	—	0	0.0

Notes: * Too turbid to count.
— = All animals dead.

LC50 = 17.5%.

TABLE 5

Mysidopsis bahia
WATER QUALITY MEASUREMENTS
FOR REFERENCE TOXICANT (S.D.S) TEST

Concentration (mg/L)	Rep	Day 0 pH	Day 0 DO	Day 0 °C	Day 0 Sal	Day 1 pH	Day 1 DO	Day 1 °C	Day 1 Sal	Day 2 pH	Day 2 DO	Day 2 °C	Day 2 Sal	Day 3 pH	Day 3 DO	Day 3 °C	Day 3 Sal	Day 4 pH	Day 4 DO	Day 4 °C	Day 4 Sal
Control	**1**	8.00	7.5	19.6	30	8.06	6.5	18.6	31	8.10	7.0	18.7	33	7.93	5.9	20.6	33	7.93	6.7	21.8	33
	2					8.10	6.5	18.5	31	8.06	6.9	18.8	33	7.92	5.7	20.6	33	7.92	6.6	21.9	33
	3					8.10	6.6	18.6	31	8.07	6.7	19.0	31	7.95	5.7	20.9	33	7.95	6.6	21.8	33
1.9	**1**	8.12	7.6	19.6	30	8.11	6.7	18.9	31	8.06	6.7	19.1	32	8.00	6.0	20.9	33	7.92	6.6	21.8	33
	2					8.14	6.7	18.8	30	8.12	6.7	19.2	31	8.02	6.0	21.0	33	7.95	6.6	21.8	33
	3					8.07	6.5	18.9	30	8.09	6.7	19.3	31	7.96	6.0	21.2	33	7.93	6.6	21.8	33
3.1	**1**	8.15	7.6	19.7	30	7.98	5.6	18.6	31	8.03	6.7	18.9	32	7.98	5.8	20.8	33	7.97	6.6	21.8	33
	2					7.98	5.5	18.6	31	8.07	6.6	18.7	32	7.97	5.8	20.8	33	7.97	6.6	21.8	33
	3					8.01	5.7	18.7	30	8.06	6.7	19.2	31	7.98	5.8	21.1	33	7.97	6.6	21.9	33
6.25	**1**	8.15	7.7	19.7	29	7.92	4.7	18.7	30	8.00	6.7	18.9	31	7.93	5.7	20.7	33	7.96	6.6	21.8	33
	2					7.91	4.7	18.9	30	7.97	6.6	19.1	31	7.97	5.7	20.9	33	7.96	6.7	21.8	33
	3					7.99	4.5	18.9	30	7.98	6.3	19.4	30	7.91	5.8	21.1	33	7.89	6.6	21.9	33
12.5	**1**	8.15	7.7	19.7	29	7.98	4.7	18.9	30	7.85	5.6	19.5	30	7.93	5.7	21.4	31	7.92	6.4	21.8	33
	2					7.95	4.5	18.9	30	7.89	5.5	19.5	30	7.92	5.7	21.3	31	7.92	6.4	21.9	33
	3					7.97	4.5	18.9	30	7.81	5.5	19.4	30	7.84	5.4	21.2	31	7.81	6.4	21.8	33
25	**1**	8.15	7.7	19.7	29	8.07	5.1	18.9	29	—	—	—	—	—	—	—	—	—	—	—	—
	2					8.09	5.2	18.7	29	—	—	—	—	—	—	—	—	—	—	—	—
	3					8.07	5.2	18.7	29	7.73	4.5	19.3	30	7.79	5.2	21.4	31	—	—	—	—
Min		8.00	7.5	19.6	29	7.91	4.5	18.5	29	7.73	4.5	18.7	30	7.79	5.2	20.6	31	7.81	6.4	21.8	33
Max		8.15	7.7	19.7	30	8.14	6.7	18.9	31	8.12	7.0	19.5	33	8.02	6.0	21.4	33	7.97	6.7	21.9	33

Note: — = All animals dead.

TABLE 6

Mysidopsis bahia
SURVIVAL DATA FOR REFERENCE TOXICANT (S.D.S.) TEST

Concentration (mg/L)	Rep	Initial Added	Day 1	Day 2	Day 3	Day 4	% Survival	Average % Survival
Control	**1**	10	10	NC	10	10	100	
	2	10	10	NC	10	9	90	
	3	10	10	NC	10	10	100	96.7
1.9	**1**	10	10	NC	10	10	100	
	2	10	10	NC	10	10	100	
	3	10	10	NC	10	10	100	100.0
3.1	**1**	10	10	NC	10	10	100	
	2	10	10	NC	10	9	90	
	3	10	10	NC	10	9	90	93.3
6.25	**1**	10	9	NC	8	7	70	
	2	10	10	NC	10	10	100	
	3	10	10	NC	9	8	80	83.3
12.5	**1**	10	6	NC	5	5	50	
	2	10	7	NC	7	7	70	
	3	10	8	NC	5	5	50	56.7
25	**1**	10	0	—	—	—	0	
	2	10	0	—	—	—	0	
	3	10	1	NC	0	—	0	0.0

Note: — = All animals dead.
NC = Not counted

LC50 = 13.2.

4.0
REFERENCES

U.S. EPA. 1991. Methods for measuring acute toxicity of effluents to freshwater and marine organisms, 4th ed. EPA 600/4-90/027, September, 1991.

TECHNICAL MEMORANDUM

PREPARED FOR: StarKist Samoa, Inc.
Chicken of the Sea (COS) Samoa Packing Company, Inc.

PREPARED BY: Steve Costa and Karen Glatzel/**gdc**
David Wilson/CH2M HILL/SEA

DATE: 31 December 1998

SUBJECT: **Bioassay Testing of Effluent November 1998 Sampling**

PROJECT: 147323.JC.EM

Purpose

This memorandum presents the results of the bioassay testing of the Joint Cannery Outfall effluent sample that was collected in November 1998. This is the twelfth required semi-annual test. Separate technical memoranda are being prepared to describe the results of concurrent effluent chemistry testing.

Study Objectives

Section D.1 of the StarKist Samoa and COS Samoa Packing NPDES permits requires that semi-annual definitive acute bioassays (96-hour static bioassays) be conducted on the cannery effluent. The purpose of these bioassays is to determine whether, and at what effluent concentration, acute toxicity may be detected for the effluent.

U.S. EPA has conducted a number of reviews of the effluent sampling, analysis, and bioassay tests. All comments from U.S. EPA have been incorporated into either the Standard Operating Procedures or have been incorporated into the procedures by the laboratory doing the test, Advanced Biological Testing, Inc., as documented in previous reports.

The bioassays were originally specified to be conducted using the white shrimp, *Penaeus vannami* (postlarvae). In the event *Penaeus vannami* is not available at the time of the tests, a substitute species, *Mysidopsis bahia*, has been approved by U.S. EPA (CH2M HILL, 26 January 1995). For the November 1998 sampling, *Penaeus vannami* was not available and *Mysidopsis bahia* was used.

The acute bioassay effluent sampling must be concurrent with effluent sampling for chemical analysis. Effluent samples are to be collected as 24-hour composite samples. The effluent acute bioassay was conducted using a combined composite effluent sample made up from the composite effluent samples from the StarKist Samoa and COS Samoa Packing facilities, as approved by EPA. This combined effluent bioassay is representative of the wastewater discharged from the joint cannery outfall to Pago Pago Harbor.

Effluent Sampling Methods

Between 1200 on 19 November 1998 and 0900 on 20 November 1998, 24-hour, flow-weighted, composite samples of final effluent were collected from both the StarKist Samoa and COS Samoa Packing effluent discharges. Samples were collected from the established effluent sampling sites following the routine composite sample collection schedule for the plants. Detailed sampling procedures are described in the technical memorandum presenting the March 1995 effluent bioassay sampling.

A total of eight grab samples were collected into pre-cleaned 1-gallon plastic cubitainers at each plant. Samples were collected at approximately three-hour intervals over a 24 hour period. The samples were stored on ice until the completion of the 24-hour sampling period. After all samples were collected a flow-proportioned composite sample was prepared. The grab sample collection times and the relative effluent volumes calculated from plant flow records are summarized in Table 1. The relative effluent volumes were used to prepare the final composite sample, which was used to fill the sample container shipped to the laboratory for testing.

A 5-gallon cubitainer containing the composite sample was packed on ice in an ice chest for shipment to the laboratory. A chain-of-custody form for the sample was completed and then sealed into a zip-lock bag and taped inside the lid of the ice chest. The sample was shipped via DHL on flights from Pago Pago to Honolulu and then to San Francisco. Samples were received by the testing laboratory on 23 November 1998. The chain-of-custody form is provided in Attachment I.

Bioassay Testing Procedures

The bioassay tests were conducted by Advanced Biological Testing Inc., Rohnert Park, California. The testing procedures and results of the bioassay tests are provided in "*Results of a Bioassay Conducted on an Effluent Sample from the Joint Cannery Outfall in American Samoa Using Mysidopsis bahia*" dated 17 December 1998 included as Attachment II. This report summarizes the 96-hour acute bioassay test conducted with reference to U.S. EPA document *EPA/600/4-90/027F,* August 1993, as the source of methods for conducting the test.

The bioassay test was conducted considering and including U.S. EPA's comments on previous bioassay tests, as documented in previous reports. A brine control was run and a comparison was made with the dilution water "laboratory control". The test organisms were required to be 1 to 5 days old, with a 24-hour range in age, and the test temperature was to be held at 20 ±1°C or 25 ±1°C. For this bioassay, three day old *Mysidopsis bahia* were used since penaeids were not available. Mysids were tested at 25 ±2°C. Because of the demonstrated potential for a lethal immediate dissolved oxygen demand (IDOD), discussed and documented in previous technical memoranda describing the first two bioassay tests, each bioassay test chamber was continuously aerated during the bioassay tests to maintain adequate levels of dissolved oxygen (DO). Bioassay tests were carried out for effluent concentrations of 50, 25, 12.5, 6.25, and 3.1% as vol:vol dilutions in seawater. Water quality was monitored daily and parameters measured included DO, pH, salinity, temperature, and ammonia. Additionally, a reference toxicant of sodium dodecyl sulfonate (SDS) was made up of a 2-gram per liter stock solution in distilled water and tested at concentrations of 25, 12.5, 6.25, 3.1, and 1.9 mg/L in 31 ppt seawater for a 96-hour test.

Results

The results of the bioassay tests are summarized as follows:

***Mysidopsis bahia* Effluent Bioassay.** All results from the bioassay tests are included in Attachment II. The results of the mysid bioassay tests indicate the LC_{50} for the effluent tested was 15 percent. The No Observable Effects Concentration (NOEC) for the 96-hour bioassay was 6.25 percent and the Least Observable Effects Concentration (LOEC) was 12.5 percent. The calculated value of toxicity units (TU) was 16.

***Mysidopsis bahia* Reference Toxicant Bioassay.** The reference toxicant had a LC_{50} of 15.2 mg/l. The laboratory mean was 14.53 ± 5.06 mg/l with the data falling within one standard deviation of the laboratory mean, indicating normal sensitivity.

Discussion

Table 2 summarizes the results of the effluent bioassay tests for the samples collected in the November 1998 sampling compared to the previous bioassay tests. The LC_{50}, NOEC and LOEC are within the range obtained from previous reports where *Mysidopsis bahia* was used in place of *Penaeus vannami*.

Conclusions

The bioassay tests for the Joint Cannery Outfall effluent for November 1998 do not indicate effluent toxicity levels to be of concern. As discussed in the previous bioassay test reports on the effluent, the time scale of the mixing of the effluent with the receiving water is on the order of minutes to seconds to achieve dilutions that will eliminate possible toxic effects as reflected by the bioassay results. For example, an NOEC of 6.25% which was observed in November 1998, corresponds to a dilution of 16:1 which is achieved within a time frame of seconds and within a few meters of the discharge point. The discharge is located in about 180 feet of water and the effluent toxicity tests indicate that the discharge is diluted to non-toxic levels immediately after discharge and well within the initial dilution plume.

Table 1
StarKist Samoa and COS Samoa Packing 24-hour Composite Effluent Sample for Bioassay Testing
19 – 20 November 1998

Grab Sample Number	COS Samoa Packing		StarKist Samoa		COS Samoa Packing Percent of Total Flow	StarKist Samoa Percent of Total Flow
	Sampling Date and Time	Effluent Flow Rate (mgd)	Sampling Date and Time	Effluent Flow Rate (mgd)		
	11/19/98		11/19/98			
1	1200	0.88	1200	1.82	4.6	9.5
2	1500	0.88	1500	1.65	4.6	8.6
3	1800	0.88	1800	1.29	4.6	6.7
4	2100	0.80	2100	1.47	4.2	7.7
5	2400	0.80	2400	1.46	4.2	7.6
	11/20/98		11/20/98			
6	0300	0.80	0300	1.50	4.2	7.8
7	0600	0.80	0600	1.61	4.2	8.4
8	0900	0.90	0900	1.59	4.7	8.3
Total		6.74		12.39	35.3	64.6
Mean		0.84		1.55		

Table 2
StarKist Samoa and COS Samoa Packing
Combined Effluent Bioassay Results

Date	*Species*	Parameters		
		LC 50	NOEC	LOEC
2/93	*Penaeus vannami*	4.8%[1]	3.1%	6.25%
10/93	*Penaeus vannami*	15.67%	3.1%	6.25%
2/94	*Penaeus vannami*	15.76%	<1.6%	1.6%
10/94	***Mysidopsis bahia***[2]	**31.2%**	**25%**	**50%**
3/95	*Penaeus vannami*	14.8%	6.25%	12.5%
3/95	***Mysidopsis bahia***[3]	**10.8%**	**6.25%**	**12.5%**
2/96	*Penaeus vannami*	>50%	>50%	>50%
2/96	***Mysidopsis bahia***[3]	**28.36%**	**12.5%**	**25%**
3/96	*Penaeus vannami*	44.4%	25%	50%
11/96	*Penaeus vannami*	7.11%	3.1%	6.25%
03/97	*Penaeus vannami*	39.36%	12.5%	25%
09/97	*Penaeus vannami*[4]	12.3%	6.25%	12.5%
06/98	***Mysidopsis bahia***[2]	**17.2%**	**6.25%**	**12.5%**
11/98	***Mysidopsis bahia***[2]	**15%**	**6.25%**	**12.5%**

[1]The February 1993 samples were not aerated until after the first day of the test. For subsequent tests the samples were aerated for the entire duration of the tests.
[2]*Mysidopsis bahia* substitutes as *Penaeus vannami* not available, as directed by U. S. EPA.
[3]*Mysidopsis bahia* used in addition to *Penaeus vannami* as described in text. Only one species is required by the permit conditions.
[4]Stage 1 (3 mm) *Penaeus vannami* were used for testing as older Stage 7 and 8 (8-10 mm) *Penaeus vannami* were not available.

ATTACHMENT I

CHAIN-OF-CUSTODY FORM

JOINT CANNERY OUTFALL EFFLUENT SAMPLE
19 – 20 November 1998

ATTACHMENT II

LABORATORY REPORT
Advanced Biological Testing
96-hour Acute Bioassay

JOINT CANNERY OUTFALL EFFLUENT SAMPLE
19 – 20 November 1998

RESULTS OF BIOASSAYS CONDUCTED ON AN EFFLUENT SAMPLE FROM THE JOINT CANNERY OUTFALL IN AMERICAN SAMOA
Using *Mysidopsis bahia*

Prepared for:

CH2M Hill California, Inc.
1111 Broadway
Oakland, CA 94607
Project # 107091.EL.97

Prepared by:

Advanced Biological Testing Inc.
5685 Redwood Drive, Suite 105
Rohnert Park, CA 94928

December 17, 1998

Ref: 9839

1.0 INTRODUCTION

At the request of CH2M Hill (Project # PDX 30702), Advanced Biological Testing conducted a four day effluent bioassay test on Mysidopsis bahia using effluents collected from the joint cannery outsell at the Starkest and Van Camp tuna canneries in American Samoa. The studies were run using methods generally specified in EPA 1991. Penaeus is the preferred species according to the NPDES permit, however when Penaeus are unavailable, Mysidopsis has been substituted. Penaeus was not available to start this test and Mysidopsis was used instead.

The study was conducted at the Advanced Biological Testing Laboratory in Rohnert Park, California, and was managed by Mr. Mark Fisler.

2.0 METHODS

2.1 EFFLUENT SAMPLING

The effluents were sampled on November 20, 1998 by cannery personnel under the supervision of CH2M Hill. The sample was received by the laboratory on November 23, 1998. One five gallon carboy was provided and maintained in an ice-filled cooler from the date of sampling until laboratory receipt. The sample was at 5°C upon receipt.

2.2 SAMPLE PREPARATION

The salinity of the effluent sample was 12 ppt and required salinity adjustment to 30 ppt. The effluent salinity was increased to 30 ppt with 100 ppt natural seawater brine. The brine was made from frozen Bodega Bay seawater. Due to the dilution of the effluent with the brine solution, the initial maximum concentration of effluent was 80%. The highest initial test concentration was made by diluting the 80% effluent with Bodega Bay seawater to an actual effluent concentration of 50%. The dissolved oxygen level in the sample was low. The initial total ammonia was approximately 6 ppm (3.04 ppm in the 50% test sample).

The effluents were tested at an actual effluent concentration series of 50%, 25%, 12.5%, 6.25%, and 3.1% as vol:vol dilution in seawater. A brine control was run with the test to assess the potential toxicity from the added brine. The diluent and the control water were filtered seawater from Bodega Bay. The dilutions were brought to the test temperature (20 ± 2°C) and aerated continuously. Based upon the previous testing, these effluents have an increasing biological oxygen demand, with a significant peak at 10-14 hours after test initiation. Previous testing of this effluent conducted without initial aeration demonstrated significant toxicity at 24 hours (or before); therefore aeration was carried out from the beginning of the test. According to EPA methods the test chambers were renewed with retained effluents held under refrigeration from test initiation on Day 2.

A reference toxicant was run using concentrations initially provided by the EPA. The toxicant was sodium dodecyl sulfonate (SDS) made up as a 2 grams per liter stock solution in distilled water. The tested concentrations were set at 25, 12.5, 6.25, 3.1, and 1.9 mg/L in 31 ppt seawater.

2.3 TESTING PROCEDURES

The bioassays were carried out on two day old larvae of Mysidopsis bahia supplied by Aquatox in Arkansas. The mysids were received on November 24, 1998 and were used immediately. Five replicates of each concentration were tested with ten animals per replicate. Water quality was monitored daily as initial quality on Day 0 and final water quality on Days 1-4. Parameters measured included dissolved oxygen, pH, salinity, total ammonia, and temperature.

2.4 STATISTICAL ANALYSIS

At the conclusion of the test, the survival data were evaluated statistically using ToxCalc™ to determine ECp, NOEC, and LOEC values where appropriate. ToxCalc™ is a comprehensive statistical application that follows standard guidelines for acute toxicity data analysis. Statistical effects can be measured by the ECp, the estimated concentration that causes any effect, either lethal (LC) or sublethal (IC), on p% of the test population. The LCp is the point estimate of the concentration at which a lethal effect is observed in p% of the test organisms. ECp values include 95% confidence limits if calculable.

3.0 RESULTS

3.1 INTRODUCTION

Tables 1 through 6 present the results of the Mysidopsis testing. The test conditions are summarized in Table 1. In the test, water quality measurements were within the acceptable limits provided in EPA 1991. Temperature was maintained at 20 ± 2°C; the pH remained relatively stable, and the salinity increased very slightly as would be expected in a static test (Tables 2 and 3). Aeration was maintained in all chambers for the duration of the test. The test solutions were renewed with reserved effluent at 48 hrs.

Initial ammonia was 3.04 ppm in the 50% effluent and was proportionally diluted at lower percentage concentrations. The LC50 for the effluent was 15% (95% confidence limits = 12.5% to 18%). There was significant mortality at the 12.5%, 25% and 50% concentrations compared to the control (Table 4). The NOEC was 6.25%, and the LOEC was 12.5%. The TU was 16.

The reference toxicant test had an LC50 of 15.2 mg/L (Tables 5 and 6). The laboratory mean for *Mysidopsis bahia* was 14.53 mg/L (SD = 5.08 mg/L). The data is within one standard deviation of the laboratory mean, indicating normal sensitivity.

TABLE 1

Bioassay Procedure And Organism Data
For the Survival Bioassay
Using Mysidopsis bahia (U.S. EPA 1991)

Parameter	Data
Sample Identification	
Sample ID(s)	981123-1
Date Sampled	11/20/98
Date Received at ABT	11/23/98
Volume Received	Five gallons
Sample Storage Conditions	4°C in the dark
Test Species	Mysidopsis bahia
Supplier	Aquatox, Hot Springs, Arkansas
Collection location	In house colony
Date Acquired	11/24/98
Acclimation Time	Used immediately
Acclimation Water	Shipping water
Acclimation Temperature	20±2°C
Age group	Two day old larvae
Test Procedures	
Type; Duration	Acute, static/renewal at 48 hours
Test Dates	11/24/98 to 11/28/98
Control Water	Bodega Bay seawater
Test Temperature	20± 2°C
Test Photoperiod	14 L : 10 D
Salinity	30± 2 ppt
Test Chamber	1000 mL jars
Animals/Replicate	10
Exposure Volume	500 mL
Replicates/Treatment	5
Feeding	Brine shrimp (<24 hr old nauplii)
Deviations from procedures	None

Table 2

Mysidopsis bahia
Initial Water Quality Measurements
for the Mysid Effluent Test
Test Dates: 11/24/98 to 11/2898

Concentration	Day 0					Day 2				
(%)	pH	DO	NH 3	°C	Sal	pH	DO	NH 3	°C	Sal
Control	7.93	7.7	0.10	18.5	29	8.04	7.8	0.13	19.8	30
Brine	7.98	7.7	0.11	18.6	28	8.04	7.7	0.16	19.8	30
3.1	7.96	7.7	0.13	18.5	29	8.00	7.7	0.21	19.9	30
6.25	7.94	7.6	0.26	18.6	29	7.97	7.5	0.28	19.9	30
12.5	7.90	7.5	0.64	18.9	29	7.97	7.3	0.51	20.0	30
25	7.90	7.5	1.27	18.9	29	7.94	7.3	1.03	19.9	30
50	7.40	7.5	3.04	19.4	29	7.71	5.7	2.03	19.4	30
Min	7.40	7.5	0.10	18.5	28	7.71	5.7	0.13	19.4	30
Max	7.98	7.7	3.04	19.4	29	8.04	7.8	2.03	20.0	30

Table 4

Mysidopsis bahia
Summary of Results for the Mysid Effluent Test

Concentration (%)	Rep	Initial Added	Day 1	Day 2	Day 3	Day 4	% Survival	Average % Survival
Control	**1**	10	10	10	10	10	100	
	2	10	10	10	10	9	90	
	3	10	9	10	10	9	90	
	4	10	10	10	10	8	80	
	5	10	10	10	10	10	100	92.0
Brine Control	**1**	10	10	10	10	9	90	
	2	10	10	10	10	10	100	
	3	10	10	10	10	10	100	
	4	10	10	10	10	10	100	
	5	10	10	10	10	9	90	96.0
3.1	**1**	10	10	10	10	9	90	
	2	10	10	10	10	9	90	
	3	10	10	10	10	9	90	
	4	10	9	9	9	9	90	
	5	10	10	9	9	8	80	88.0
6.25	**1**	10	10	9	9	10	100	
	2	10	10	10	10	4	40	
	3	10	10	10	10	10	100	
	4	10	10	10	10	9	90	
	5	10	10	10	10	8	80	82.0
12.5	**1**	10	*	10	*	9	90	
	2	10	*	10	*	9	90	
	3	10	*	8	*	8	80	
	4	10	*	10	*	1	10	
	5	10	*	0	—	—	0	54.0
25	**1**	10	*	9	*	6	60	
	2	10	*	0	—	—	0	
	3	10	*	10	*	8	80	
	4	10	*	8	*	1	9	
	5	10	*	0	—	—	0	29.8
50	**1**	10	*	8	*	4	40	
	2	10	*	1	*	0	0	
	3	10	*	9	*	0	0	
	4	10	*	6	*	0	0	
	5	10	*	6	*	0	0	8.0

Notes: * Too turbid to count.
— = All animals dead.

LC50 = 15%.

Table 4

Mysidopsis bahia
Summary of Results for the Mysid Effluent Test

Concentration (%)	Rep	Initial Added	Day 1	Day 2	Day 3	Day 4	% Survival	Average % Survival
Control	1	10	10	10	10	10	100	
	2	10	10	10	10	9	90	
	3	10	9	10	10	9	90	
	4	10	10	10	10	8	80	
	5	10	10	10	10	10	100	92.0
Brine	1	10	10	10	10	9	90	
Control	2	10	10	10	10	10	100	
	3	10	10	10	10	10	100	
	4	10	10	10	10	10	100	
	5	10	10	10	10	9	90	96.0
3.1	1	10	10	10	10	9	90	
	2	10	10	10	10	9	90	
	3	10	10	10	10	9	90	
	4	10	9	9	9	9	90	
	5	10	10	9	9	8	80	88.0
6.25	1	10	10	9	9	10	100	
	2	10	10	10	10	4	40	
	3	10	10	10	10	10	100	
	4	10	10	10	10	9	90	
	5	10	10	10	10	8	80	82.0
12.5	1	10	*	10	*	9	90	
	2	10	*	10	*	9	90	
	3	10	*	8	*	8	80	
	4	10	*	10	*	1	10	
	5	10	*	0	—	—	0	54.0
25	1	10	*	9	*	6	60	
	2	10	*	0	—	—	0	
	3	10	*	10	*	8	80	
	4	10	*	8	*	1	9	
	5	10	*	0	—	—	0	29.8
50	1	10	*	8	*	4	40	
	2	10	*	1	*	0	0	
	3	10	*	9	*	0	0	
	4	10	*	6	*	0	0	
	5	10	*	6	*	0	0	8.0

Notes: * Too turbid to count.
— = All animals dead.

LC50 = 15%.

Table 5

Mysidopsis bahia

Water Quality Measurements for the Mysid Reference Toxicant (SDS) Test

Concentration (mg/L)	Rep	Day 0 pH	Day 0 DO	Day 0 °C	Day 0 Sal	Day 1 pH	Day 1 DO	Day 1 °C	Day 1 Sal	Day 2 pH	Day 2 DO	Day 2 °C	Day 2 Sal	Day 3 pH	Day 3 DO	Day 3 °C	Day 3 Sal	Day 4 pH	Day 4 DO	Day 4 °C	Day 4 Sal
Control	**1**	7.95	7.3	18.8	30	7.91	6.7	19.2	30	7.80	6.9	19.7	30	7.89	6.8	20.3	30	7.89	7.6	19.7	32
	2					7.90	6.7	19.2	30	7.84	6.9	20.0	30	7.90	6.7	20.5	30	7.89	7.5	19.7	32
	3					7.89	6.7	19.1	30	7.82	6.9	20.1	30	7.91	6.7	20.5	30	7.90	7.4	19.7	32
1.9	**1**	7.93	7.5	19.0	30	7.84	6.1	19.2	30	7.77	6.9	20.1	30	7.85	6.7	20.5	31	7.85	7.4	19.6	32
	2					7.79	6.1	19.3	30	7.77	6.7	20.1	30	7.86	6.6	20.6	31	7.87	7.3	19.8	32
	3					7.84	6.1	19.3	30	7.78	6.7	20.2	30	7.87	6.6	20.5	31	7.88	7.2	19.8	32
3.1	**1**	7.95	7.4	19.0	30	7.72	5.1	19.2	30	7.72	6.3	20.2	30	7.83	6.3	20.6	31	7.84	7.2	19.9	32
	2					7.74	5.2	19.2	30	7.76	6.5	20.2	30	7.85	6.3	20.6	31	7.87	7.2	19.9	32
	3					7.75	5.3	19.3	30	7.77	6.5	20.3	30	7.87	6.4	20.7	31	7.88	7.2	19.8	32
6.25	**1**	7.96	7.5	19.2	30	7.77	5.2	19.4	30	7.74	6.5	20.2	30	7.89	6.5	20.8	31	7.88	7.1	19.8	32
	2					7.72	5.1	19.3	30	7.73	6.5	20.3	30	7.88	6.6	20.7	31	7.87	7.1	19.8	32
	3					7.68	4.5	19.3	30	7.71	6.5	20.3	30	7.89	6.6	20.7	31	7.87	7.0	19.8	32
12.5	**1**	7.97	7.5	19.7	29	7.67	4.5	19.3	30	7.60	5.7	20.3	30	7.82	6.5	20.7	31	7.79	6.6	19.8	32
	2					7.61	4.0	19.3	30	7.56	5.8	20.4	30	7.80	6.4	20.6	31	7.79	6.6	19.9	32
	3					7.60	3.9	19.3	30	7.57	5.7	20.4	30	7.83	6.4	20.6	31	7.79	6.5	19.8	32
25	**1**	7.98	7.5	19.3	29	7.79	5.3	19.3	29	7.55	5.7	20.3	30	7.65	5.5	20.6	30	7.68	6.6	19.8	31
	2					7.80	5.3	19.3	29	7.53	5.7	20.4	30	7.61	5.5	20.7	30	—	—	—	—
	3					7.79	5.4	19.5	29	7.47	4.9	20.4	30	—	—	—	—	—	—	—	—
Min		7.93	7.3	18.8	29	7.60	3.9	19.1	29	7.47	4.9	19.7	30	7.61	5.5	20.3	30	7.68	6.5	19.6	31
Max		7.98	7.5	19.7	30	7.91	6.7	19.5	30	7.84	6.9	20.4	30	7.91	6.8	20.8	31	7.90	7.6	19.9	32

Note: — = All animals dead.

Table 6

Mysidopsis bahia

Summary of Results for the Mysid Reference Toxicant Test

Concentration (mg/L)	Rep	Initial Added	Day 1	Day 2	Day 3	Day 4	% Survival	Average % Survival
Control	**1**	10	10	10	10	8	80	
	2	10	9	8	9	9	90	
	3	10	10	10	10	10	100	90.0
1.9	**1**	10	10	10	10	10	100	
	2	10	10	10	10	10	100	
	3	10	10	10	10	10	100	100.0
3.1	**1**	10	9	8	9	8	80	
	2	10	10	10	10	9	90	
	3	10	10	10	10	10	100	90.0
6.25	**1**	10	9	9	9	8	80	
	2	10	9	9	9	9	90	
	3	10	9	9	9	8	80	83.3
12.5	**1**	10	8	8	8	7	70	
	2	10	9	9	9	6	60	
	3	10	9	9	9	6	60	63.3
25	**1**	10	6	6	2	0	0	
	2	10	2	2	0	—	0	
	3	10	1	0	—	—	0	0.0

Note: — = All animals dead.

LC50 = 15.2 mg/L.
Laboratory mean = 14.53 ± 5.08 mg/L.

4.0
REFERENCES

U.S. EPA. 1991. Methods for measuring acute toxicity of effluents to freshwater and marine organisms, 4th ed. EPA 600/4-90/027, September, 1991.

Rcd 3/10/97

Receiving Water Quality Monitoring Report

Pago Pago Harbor, American Samoa
November 1996 Sampling

Prepared for

StarKist Samoa

NPDES Permit AS0000019

and

VCS Samoa Packing

NPDES Permi[illegible]27

No As, Hg, or PCB monitoring

U.S. Enviro[illegible]on Agency

American Samoa Enviro[illegible]l Protection Agency

Prepared by

CH2M HILL

and

gdc

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1. INTRODUCTION

This report describes the second semi-annual Pago Pago Harbor water quality monitoring field measurements done under the revised NPDES permit condition (E) for VCS Samoa Packing and StarKist Samoa. The letter from the U.S. Environmental Protection Agency implementing the changes in the permits, and the revised permit condition are included as Appendix I. The revisions apply to both permits for discharge through the Joint Cannery Outfall (JCO): VCS Samoa Packing holds NPDES permit AS0000027and StarKist Samoa holds NPDES permit AS0000019. The overall purpose of this study and the purpose of this report, a description of the study site, a brief background of the water quality monitoring work done in the Harbor, and the scope and organization of this report are described below in this section of the report. Following sections of the report describe the field data collection, the laboratory results of samples collected, and conclusions and recommendations based on the results.

1.1 PURPOSE

The purpose of the Receiving Water Quality Monitoring Program is, as described in the permit, "to determine compliance with water quality standards". To achieve this the program must, as described in the permit, "document water quality at the outfall, at areas near the zone of initial dilution (ZID) and zone of mixing (ZOM) boundaries, at areas beyond these zones where discharge impacts might reasonably be expected, and at reference/control areas". The purpose of this report is to document the second set of data, collected during November 1996, and to evaluate these data in terms of compliance with water quality standards. The second monitoring episode was originally scheduled for October 1996, but was delayed with the approval of USEPA

1.2 STUDY LOCATION

Water quality measurements and samples were obtained throughout Pago Pago Harbor, Tutuila Island, American Samoa. The island is located approximately 2300 miles southwest of Hawaii, 1600 miles northeast of New Zealand, and 1000 miles south of the equator at latitude 14° 17′ S and longitude 171° 40′ W (approximately). The general location is shown in Figure 1-1. The harbor is approximately 15,000 feet long with the entrance to the south. The outer harbor trends north-south with widths varying between 3000 and 6000 feet. The inner harbor trends east-west with the head of the harbor to the west and ranges from less than 1000 to about 3000 feet wide. Figure 1-2 shows the general harbor morphology. Maximum depths along a cross section range from less than 60 to over 200 feet, with fringing reefs periodically exposed at low tide throughout the middle and outer harbor areas.

The climate is tropical with about 200 inches of rainfall annually, air temperatures typically between 70 and 90°F, and high humidity. Orographic effects create higher rainfall in the vicinity of the harbor than at other locations on the Island. The watershed of the harbor is small relative to the harbor size with about 4.9 mi^2 of drainage area compared to about 2.4 mi^2 of water surface area. Therefore, the harbor is typically a marine dominated system with depressed salinities normally found only very close to stream mouths.

Tides are semi-diurnal with a range of about 2.5 feet and little diurnal inequality. The circulation in the Harbor is mainly wind driven with both tidal and freshwater influences generally very small except at extremely localized sites. Winds are usually from the east and southeast and are from this direction most of the time during the tradewind season, which is typically April/May through October/November. During November/December through March/April the east to southeast winds still predominate but a northwest to northeast component becomes more prevalent (the non-tradewind season).

The tuna canneries discharge through the JCO which terminates in a mulitport diffuser at a depth of approximately 176 feet in the outer harbor (see Figure 1-3). Typical flows through the outfall are approximately 2 mgd. The discharge is in the center of a mixing zone for total nitrogen (TN) and total phosphorous (TP) as shown in Figure 1-3. A small mixing zone for ammonia has also been established and is defined within 12 meters of the diffuser discharge ports.

1.3 BACKGROUND

Prior to the implementation of high strength waste segregation and outfall relocation, the canneries discharged treated wastewater into the inner harbor though two outfalls. These outfalls terminated in about 80 feet of water in open-ended pipes without diffusers. In August 1990 both canneries started high strength waste segregation and offshore ocean disposal of the high strength waste streams (those process streams highest in nitrogen, phosphorous, suspended solids, and BOD). In February 1992 both canneries began discharging treated wastewater (without the high strength waste component) through a single outfall, relocated approximately 8400 feet seaward from the previous discharge point, at about the 180-foot contour, in the outer harbor. The new outfall terminates in a diffuser consisting of four active and two inactive ports.

The current NPDES permits for both canneries, which became effective in October 1992, required monthly monitoring of water quality parameters, with emphasis on nutrients, at established monitoring stations throughout the harbor. This monitoring had been carried out by the American Samoa Environmental Protection Agency (ASEPA). In November 1995, USEPA revised the permit condition for reasons given in the notification of revision (Appendix I). The revised water quality monitoring (Appendix I) is similar to, and extends the usefulness of, the original monitoring condition. The major changes in the permit condition include:

- The frequency of sampling was reduced from monthly to semi-annually
- The number of sampling locations was increased from 17 to 20

- The number of sampling depths was changed from three to a maximum six at 30 foot

- Continuous vertical profiles of temperature, salinity, dissolved oxygen, pH, and turbidity, rather than grab samples, are now required

  increments plus near bottom (with a minimum of three samples in shallow water)

- Suspended solids was removed from the list of analytes

- Sampling for zinc and copper was added for seven locations at specified depths

The first of the monitoring episodes required by the revised permit was conducted in March 1996. This report describes the second monitoring episode required by the revised permit, which was conducted in November 1998.

1.4 SCOPE AND ORGANIZATION OF REPORT

The following sections of this report describe the field data collection (Section 2), summarize the data acquired (Section 3), and provide conclusions and recommendations (if any) based on the field data collection and results (Section 4). Section 2 includes specific information on sample station locations and times, field methods, and describes any deviations from the intended study plan. Section 3 presents summaries of field measurements and laboratory results with detailed information referenced to appendices when appropriate. Section 4 includes an evaluation of compliance with American Samoa Water Quality Standards (ASWQS) based on the data collected, and presents recommendations for changes in methodology, sampling strategies, or other requirements as appropriate. References are provided (Section 5) and appendices are included describing the specifics of the permit condition, the study and analysis plan and the revised standard operating procedures (SAP/SOP), and detailed data supplements for field measurements and laboratory analyses.

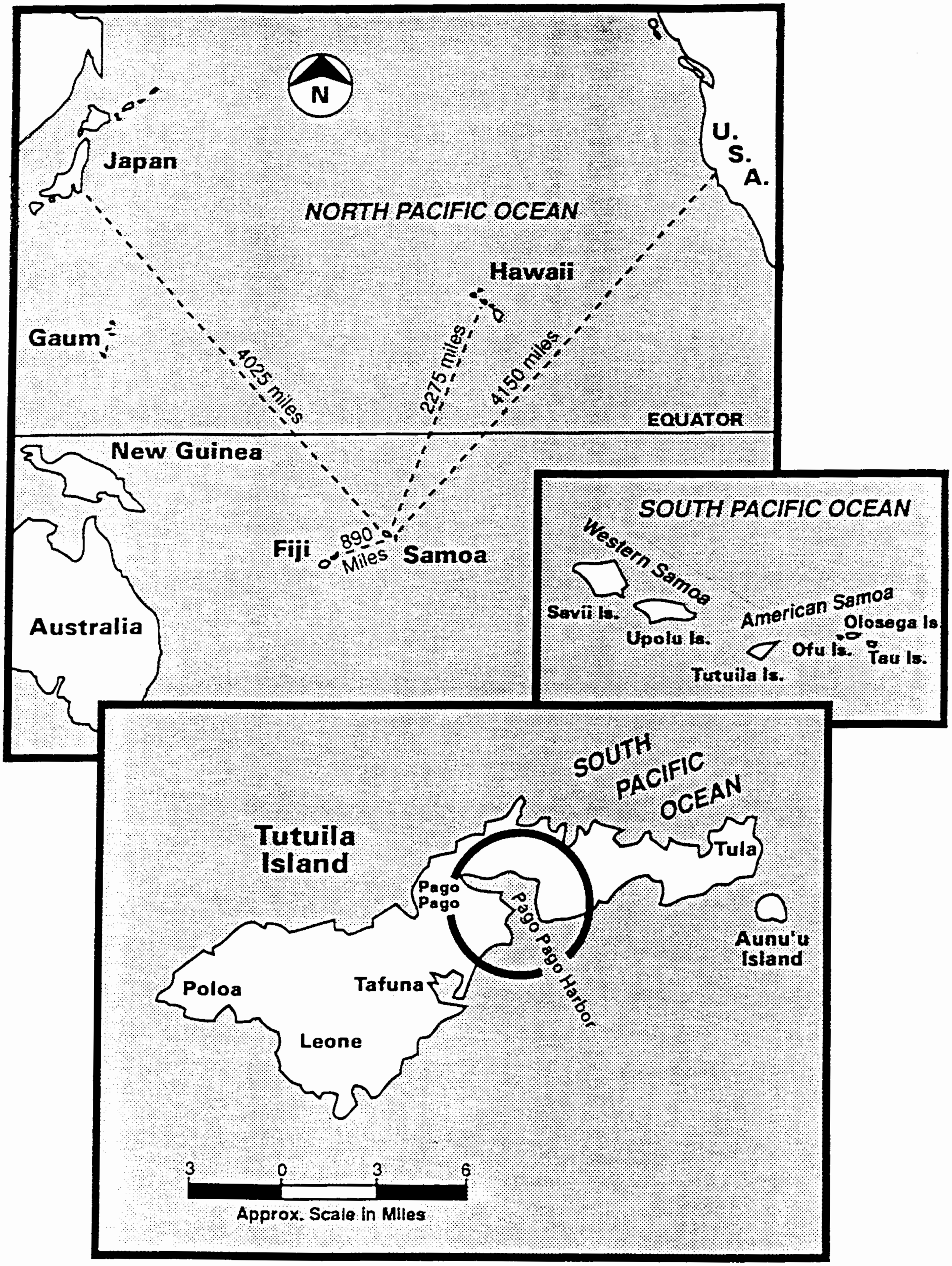

Figure 1-1
Overview of Study Site

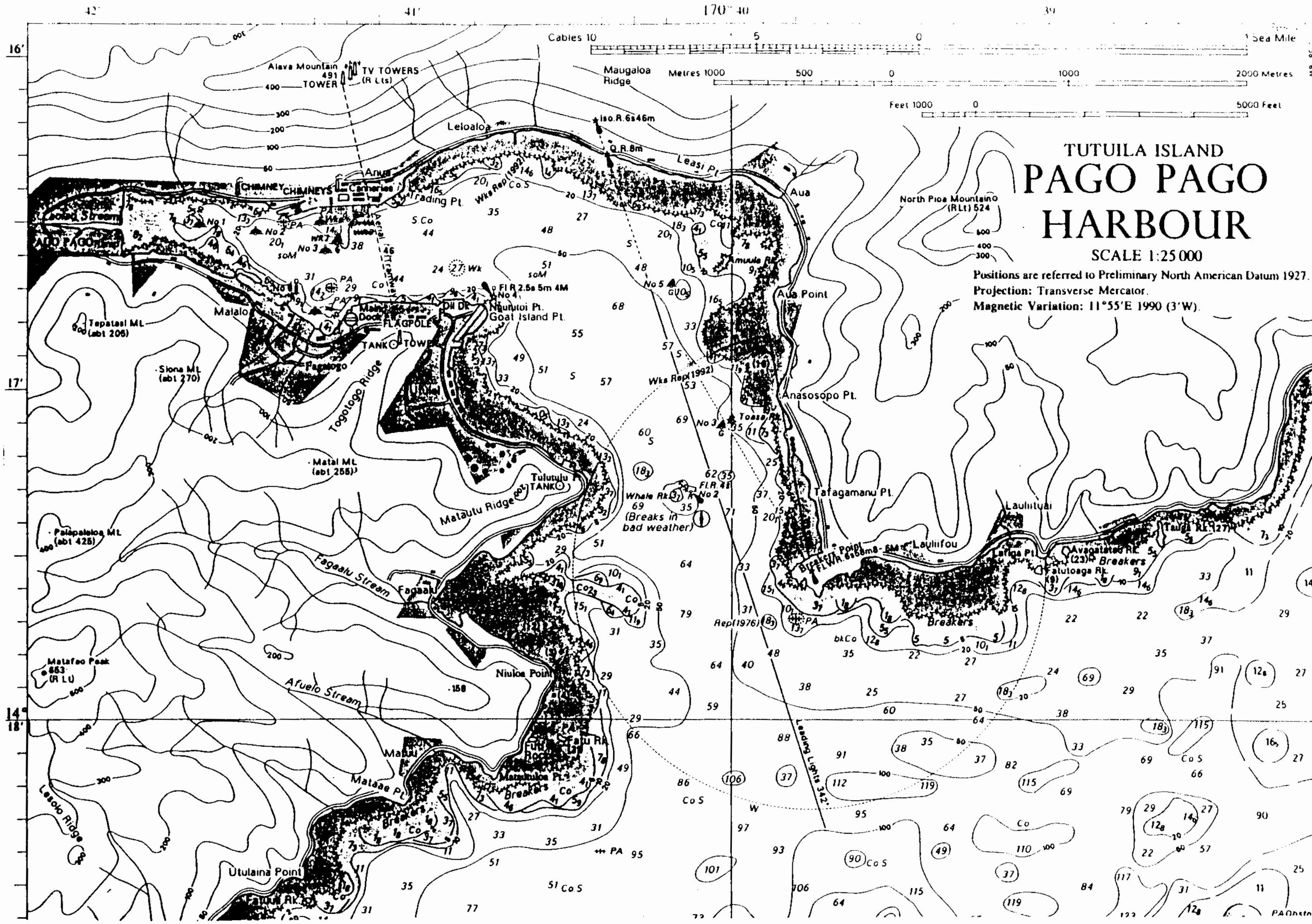

Figure 1-2
Pago Pago Harbor

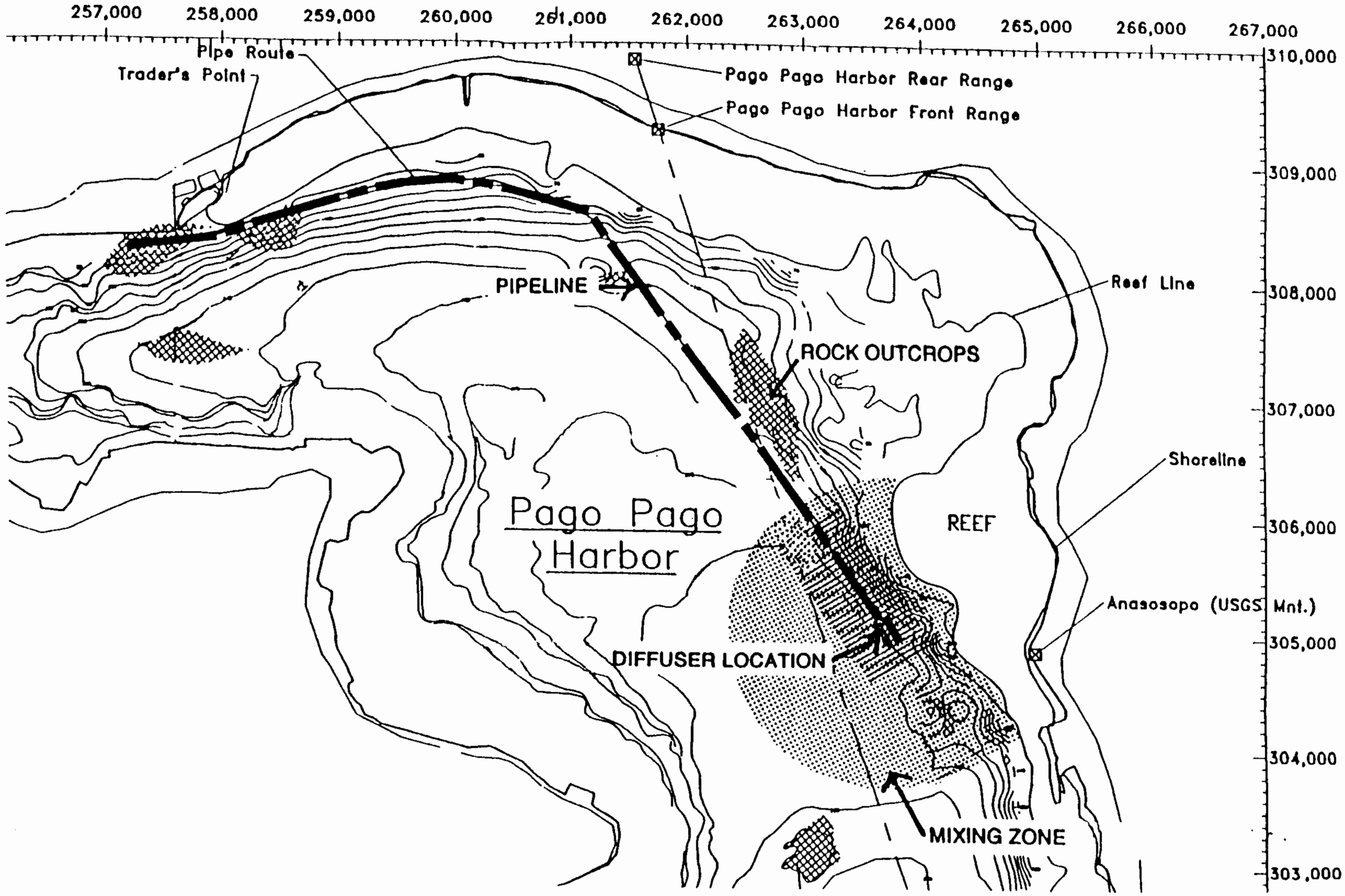

Figure 1-3
Outfall and Mixing Zone Location

2. FIELD DATA COLLECTION

A description of the field data collection during November 1996, including the methods used for field measurements and sample collection are described below. The types of data collected and the locations, dates, and times of measurements and sample collection are summarized. Deviations from the SAP/SOP are listed and discussed.

2.1 GENERAL DESCRIPTION

The field work was conducted between 19 November and 23 November 1996. The activities conducted during this time period included:

- 19 November - Sampling at stations 11,11A, 12, and 13
- 20 November - Sampling at stations 9, 9A, 10, 10A, 15, and 16
- 21 November - Sampling at stations 5, 5A, 7, 8, 8A, 14, and 18
- 22 November - Sampling at stations 6, 6A, and 17
- 23 November - Continuous profile hydrographic casts made at all stations

During sampling at designated stations water samples were collected for laboratory analysis using standard water sampling bottles (Niskin type bottles). Secchi depth and total water depth were measured at each station. Profile casts were made on November 23rd. The dissolved oxygen (DO) probe on the profiling instrument was checked prior to sampling, and was found to give unreliable readings. Attempts to field service the probe were unsuccessful. Therefore, DO was measured for each individual grab sample (at each station and each depth sampled) using a YSI DO meter (temperature and salinity internally compensated). pH was measured either in the field during the collection of individual grab samples, or using a subsample from the chlorophyll-a sample at the time of filtering as described below.

The continuous profile hydrographic casts were done using a SeaBird conductivity, temperature, depth (CTD) instrument also equipped with DO, and turbidity probes. The DO probe was not functioning, as mentioned above, and the pH probe was not available. The meter records every 0.5 seconds on both the downcast and upcast. It is equipped with a pump to provide for sufficient flushing past the sensors.

The meteorological conditions during sampling was as follows:

- 19 November (AM) - Wind from SE at 10 knots, mostly cloudy to heavy overcast
- 19 November (PM) - Wind from SE at 10 knots, mostly cloudy
- 20 November (AM) - Wind from S to SE at 5 to 10 knots, partly to mostly cloudy
- 20 November (PM) - Wind from S to SE at 5 to 10 knots, partly to mostly cloudy

- 21 November (AM) - Wind from S to SE at 5-15 knots, partly cloudy, seas at entrance 6 to 10 feet
- 21 November (PM) - Wind from SE 5-10 knots, mostly cloudy
- 22 November (AM) - Wind from SE 5-10 knots, mostly cloudy
- 22 November (PM) - Wind from SE 5-10 knots, mostly cloudy
- 23 November (AM) - Wind calm to 5 knots from N, seas decreased to 3 to 5 feet, partly cloudy
- 23 November (PM) - Same as AM

Station locations are specified in the permit both by latitude and longitude and graphically. The problems with station specification associated with the differences between various map datums and the use of GPS was described in the report on the March 1996 sampling episode. We have recorded, and permanently stored, the WGS 1984 coordinates of the stations actually occupied for the March 1996 sampling and will use the same coordinates for all future sampling episodes. The WGS coordinates occupied, and the times of station occupation, are given in Table 2-1. Figure 2-1 shows the relative locations of the stations occupied for this study.

2.2 DESCRIPTION OF FIELD METHODS

Direct field measurements included water depth, Secchi depth, and DO, in addition pH was measured using subsamples of each grab sample. These measurements were conducted as follows:

- Water depth was measured using a non-recording portable fathometer which was occasionally checked by observing the signal produced as the Secchi disk or the SeaBird were lowered and raised through the water column
- Secchi depth was determined by using a 6" diameter black and white (quartered) Secchi disk lowered through the water column on a measured line
- DO was measured using aliquots of each sample as collected in the field using a YSI Model 50B meter following the manufactures instructions for use of the meter; the meter and probe were field calibrated before and after the sampling
- pH was measured either in the field as samples were collected or using aliquots of grab samples collected for chlorophyll-a analysis using an Orion Model 250A pH meter. These samples are stored on ice and later filtered, a small subsample was used for the pH measurement.

As described above, conductivity, temperature, depth (pressure), and turbidity were measured using an internally recording profiling instrument (SeaBird CDT) which had been calibrated by the manufacturer prior to shipment to American Samoa. Salinity and sea water density were calculated from conductivity and temperature using the SeaBird supplied software.

Water samples were collected using a Niskin type sampling bottle from each depth specified in the permit (depths of collection at each station are shown in Table 2-1). The collection bottle was lowered to the appropriate depth using a measured line and allowed to hang for a minimum of 1 minute. A messenger was dropped down the line and the bottle was retrieved after being tripped by the messenger. Sample bottles as described in Table 2-2 were immediately filled and preserved as indicated in the table, stored on ice, and prepared for shipment to the laboratory as described in the SAP/SOP (Appendix II). In addition, a minimum of two liters was collected for chlorophyll-a analysis. The chlorophyll samples were later filtered through a Whatman grade GF/F glass fiber filter (0.7 microns) using a vacuum pump apparatus. The filters were treated with manganese sulfate as a preservative, frozen, and then sent to the laboratory for analysis.

2.3 DEVIATIONS FROM THE STUDY PLAN

As in any field data collection, problems and required solutions in the field, interpretation of the guidelines being used, weather, equipment malfunctions, and a variety of other factors may lead to deviations from the study plan. There were only minor deviations during this episode of field data collection which either had no substantial effect on the data recovered and in some cases actually enhanced the objectives of the study. The identified deviations for this study included the following:

- Discrete grab samples for measuring turbidity were collected, in addition to the profile data required by the permit, at selected stations in and around the mixing zone including stations 8, 8A, 14, 15, 16, 17, and 18
- DO was measured for all discrete grab samples for all stations occupied (and data from the continuous profile was discarded)
- pH was measured for all grab samples rather than as a continuous vertical profile
- Extra depths were sampled at Stations 6A and 15 (one additional depth at each station)

Most of the actions listed above were used to verify, and adjust as necessary, data being taken by the vertical profiling (CTD) instrument.

Table 2-1
PAGO PAGO HARBOR WATER QUALITY MONITORING STATION OCCUPATION SUMMARY
November 1996

Station Number	Sample Collection		CTD Casts [1]		Latitude 14° S [2]	Longitude 170° W [2]	Water Depth[3]	Secchi Depth[4]	Sampling Depths
	Date	Time	Date	Time	(minutes)	(minutes)	(feet)	(feet)	(feet)
TRANSITION ZONE									
5	11/21	09:45	11/23	11:15	17.713	39.733	240	36	S, 30, 60, 90, 120, B
5A	11/21	10:30	11/23	11:25	18.045	40.393	220	33	S, 30, 60, 90, 120, B
OUTER HARBOR									
6	11/22	10:00	11/23	15:00	17.211	40.298	201	25	S, 30, 60, 90, 120, B
6A	11/22	10:30	11/23	15:10	17.316	40.582	102	30	S, 30, 60, B
7	11/21	11:45	11/23	11:05	17.226	39.878	127	23	S, 30, 60, 90, B
8	11/21	15:45	11/23	10:50	16.843	40.098	170	18	S, 30, 60, 90, 120, B
18	11/21	11:15	11/23	11:00	17.092	40.041	192	21	S, 30, 60, 90, 120, B
MIDDLE HARBOR									
8A	11/21	16:15	11/23	10:30	16.826	40.150	173	20	S, 30, 60, 90, 120, B
9	11/20	12:00	11/23	14:30	16.562	40.194	128	31	S, 30, 60, 90, B
9A	11/20	11:00	11/23	14:20	16.293	40.559	130	28	S, 30, 60, 90, B
10	11/20	12:45	11/23	14:40	16.755	40.637	165	23	S, 30, 60, 90, 120, B
10A	11/20	13:30	11/23	14:45	16.997	40.451	123	23	S, 30, 60, 90, B
14	11/21	15:15	11/23	10:35	16.911	40.065	178	20	S, 30, 60, 90, 120, B
15	11/20	16:30	11/23	10:15	16.584	40.116	92	25	S, 30, 60, B
16	11/20	17:15	11/23	14:50	16.891	40.354	193	21	S, 30, 60, 90, 120, B
17	11/22	09:30	11/23	10:45	16.804	40.086	82	28	S, 30, B
INNER HARBOR									
11	11/19	16:30	11/23	11:45	16.480	40.947	164	20	S, 30, 60, 90, 120, B
11A	11/19	16:00	11/23	11:55	16.464	41.151	139	20	S, 30, 60, 90, B
12	11/19	15:30	11/23	12:05	16.449	41.376	64	18	S, 30, B
13	11/19	15:00	11/23	12:10	16.304	41.841	29	15	S, 15, B

Notes:
[1] CDT casts were taken on the day following the final sample collection, and were all done on the same day (23 November 96)
[2] Coordinates are as recorded by GPS using the WGS coordinate system (see text for additional details).
[3] Water depths as recorded on the day of sample collection, correspondence with the day of the CTD casts is typically within a few feet.
[4] (S) = sunny; (Sh) = shadows and/or low sun angle

Table 2-2
PAGO PAGO HARBOR WATER QUALITY MONITORING
SAMPLE ANALYSIS AND HANDLING PROCEDURES
November 1996

PARAMETER	REQUESTED ANALYTICAL METHOD	REQUESTED REPORTING DETECTION LIMIT	SAMPLE HOLDING TIME	SAMPLE CONTAINER	SAMPLE PRESERVATION
Temperature	Field Probe	0.1°C	N/A	N/A	none
Salinity	Field Probe	0.1 PSU	N/A	N/A	none
Dissolved O_2	Field Probe	0.1 mg/l	N/A	N/A	none
pH	Field Probe	0.1 SU	N/A	N/A	none
Turbidity	Field Probe	0.2 NTU	N/A	N/A	none
Turbidity[1]	EPA 180.1	0.01 NTU	48 hours [2]	500 ml plastic	none
Nitrite Nitrogen	EPA 354.1	0.001 mg/l	48 hours [2]	2 - 500 ml plastic	4°C - H_2SO_4
Nitrate + Nitrite	EPA 353.2	0.010 mg/l	28 days		
Ammonia Nitrogen	EPA 350.1	0.005 mg/l	28 days		
Total Kheldal Nitrogen	EPA 351.3	0.025 mg/l	28 days		
Total Phosphorus	EPA 365.2	0.005 mg/l	28 days		
Chlorophyll-a	SM 1002 G	0.03 mg/m^3	3 months	Whatman (0.7 micron) GF/F filter	frozen, manganese sulfate
Zinc	EPA 200.7	20 µg/l	6 months	500 ml plastic	4°C - HNO_3 to a pH of ≤ 2
Copper [3]	EPA 220.2	2 µg/l			

Notes:

[1] Turbidity samples sent to lab from selected stations only to verify probe readings. Stations selected at discretion of field team leader.

[2] Holding times for turbidity and nitrite-nitrogen are unavoidably exceeded because of logistics involved in shipping from American Samoa. The laboratory (AMTEST) agreed to test for these constituents immediately upon receipt of the samples.

[3] Analytical Resources, Inc. tested for copper using method 200.7, following extraction by coprecipitation to achieve the required detection limit.

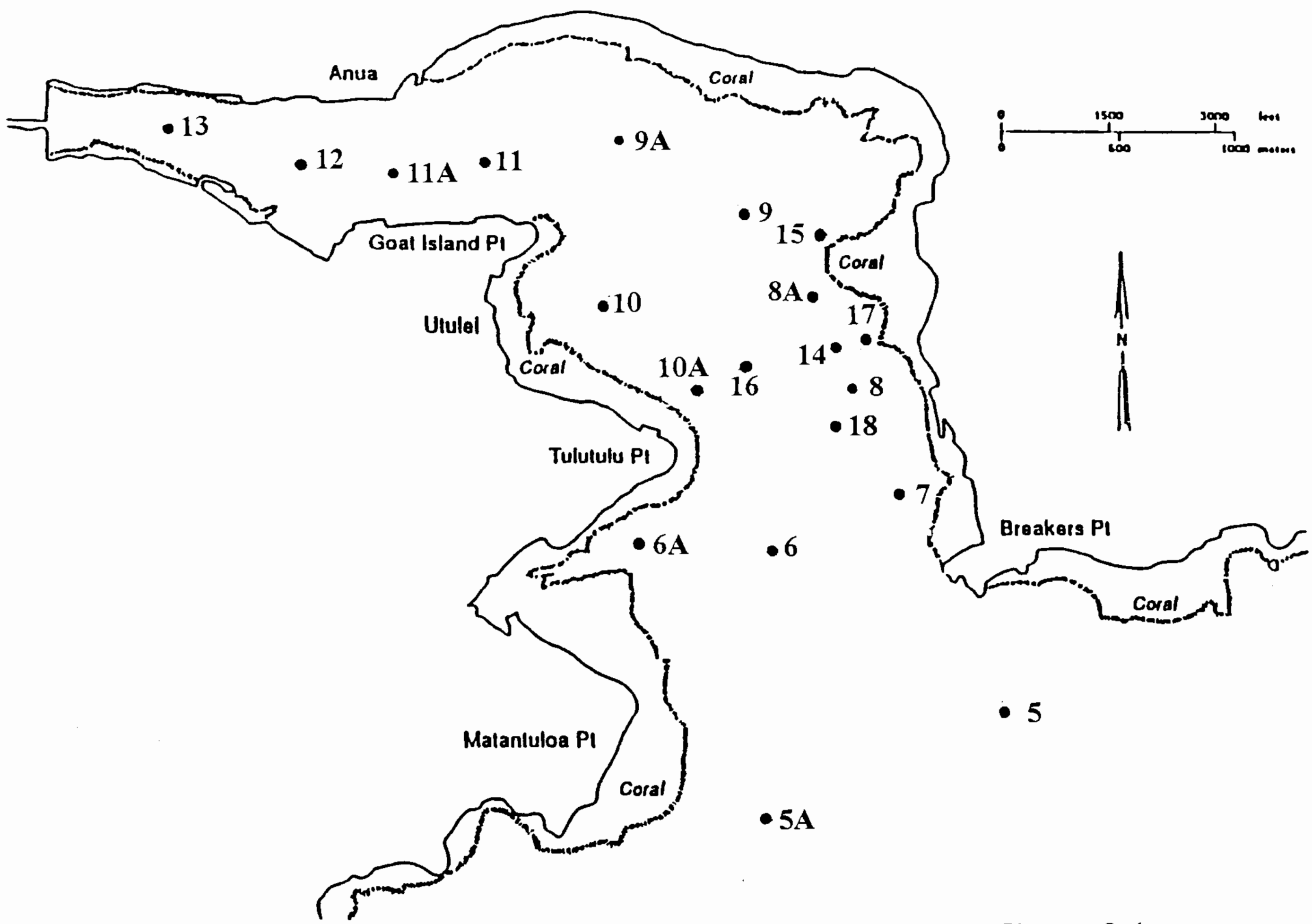

Figure 2-1
Station Locations

3. DATA SUMMARY

It is convenient to categorize the parameters measured in the field and laboratory during this study into three classes: physical and hydrographic parameters that generally describe the water column structure; nutrient and biological parameters that relate more to the health of the harbor; and trace metals. Physical and hydrographic parameters include temperature, salinity, density, DO, pH, turbidity, and Secchi depth, which is used as an indicator of light penetration. Nutrient and biological parameters include the various types of nitrogen, phosphorous, and chlorophyll-a. Zinc and copper were the trace metals of specific interest for this investigation. The results of the November 1996 sampling episode for each of these classes of parameters are presented below.

3.1 PHYSICAL HYDROGRAPHIC PARAMETERS.

The physical and hydrographic parameters measured in the field during the November 1996 harbor monitoring included (in addition to station location and total water depth): temperature, conductivity, dissolved oxygen, pH, turbidity, and light penetration by means of Secchi depth. Temperature, conductivity, and turbidity were measured as continuous vertical profiles. At selected stations turbidity was also measured in the laboratory using the water samples collected as described above. Salinity and density profiles were calculated from the CTD data using the SeaBird software.

Tables 3-1.a through 3-1.d summarize the vertical water column profile data collected with the CTD profiling instrument. The data plots of these hydrographic variables are provided in Appendix III. The Secchi depth measurements are presented in Table 2-1 above. The laboratory analyses for turbidity are given in Table 3-2. The measured values for DO and pH for each station and depth are given in Table 3-3. A brief description of each of the hydrographic parameters of interest parameters is given below.

3.1.1 Temperature

Temperature summaries are given in Table 3-1.a. There was very little variation in temperature throughout the harbor with measured values between 28 and 29.6 °C. Inner harbor temperatures were, at most, a few tenths of a degree warmer than the open ocean. The vertical temperature variations were no more than one degree. There was no identifiable effect of the discharge observable in or around the boundary of the mixing zone.

3.1.2 Salinity

Salinity summaries are provided in Table 3-1.b. As in the case of temperature, there was little or no variability longitudinally. In general there is little stratification with vertical variations typically less than 1 ppt. There is no discernible influence from the JCO discharge.

3.1.3 Density

Density (Table 3-1.c), in terms of σ_t, is summarized in Table 3-1.c. The water column is very well mixed with little indication of a strong density gradients. Vertical variations between surface and bottom were typically seen to be about 0.5 sigma-t units (1 unit is equivalent to 0.001 g/cm^3), at the harbor mouth, less than 1 unit in the outer harbor, and up to 1 unit in the inner harbor. There is little longitudinal variation and no discernible influence from the JCO discharge.

3.1.4 Turbidity

Turbidity was measured throughout the water column using a SeaPoint optical sensor mounted on the SeaBird CTD. The turbidity sensor was set for the highest resolution and lowest range and threshold possible. Even at these settings, the minimum reading of the instrument was approximately 0.13 NTU and the resolution was 0.01 NTU. That means any value lower than 0.13, even a value of zero, was recorded as 0.13 NTU. Conversations with the manufacturers of both the turbidity meter and the CTD on which it was mounted indicate the a portion of the 0.13 NTU lowest reading is an instrument offset and can be subtracted from the actual reading. However, this value is not easily determined and appropriate tests were not done to define this value in the field. Therefore, the data including the small offset is presented in this report. It is recognized that all values are reported slightly higher than they should be and the instrument detection limit is lower than 0.13 NTU.

The data from the turbidity profiles is summarized for each station in Table 3-1.d. A higher turbidity layer was often observed near bottom. The average values throughout the water column are low, generally less than 1 NTU. The ASWQS for turbidity is 0.75 NTU (median value). The median value for the continuous profiles at each station was not calculated but can be approximated from the plots in Appendix III. Compliance with the ASWQS is achieved based on the profile data. Because of the instrument characteristics, the potential problem of a undefined offset was recognized in the field and turbidity analysis was requested on selected samples in and around the mixing zone. Samples from the all stations within the mixing zone and on the mixing zone boundary were sampled for turbidity analysis. The data are given in Table 3-2 and indicate compliance with ASWQS.

3.1.5 Dissolved Oxygen

There is both vertical and longitudinal spatial variability and temporal variability of DO indicated in the data provided in Table 3-3, as was expected. There is, however, no indication of a reduction of DO in the mixing zone. There is sufficient temporal variability, depending on time of day the measurement was taken, to mask any overall trends in longitudinal spatial variation. This is consistent with the higher chlorophyll-a values than previously measured in March of 1996, and March 1995. There is a distinct vertical trend with higher values usually found near the surface. A subsurface depression is seen at some of the stations.

The measured DO was above the numerical American Samoa water quality standard (ASWQS) on a water column average basis at every station and on a point-by point basis at over 85 percent of the points sampled. [The ASWQS is that DO shall be "*Not less than 70 percent of saturation or less than 5.0 mg/l. If the natural level of dissolved oxygen is less than 5.0 mg/l, the natural level will become the standard.*"] The data available is insufficient to determine if those observed values below 5.0 are "natural" or result from the effluent discharge. However, the pattern observed indicates high productivity may be a primary factor resulting in depressed DO levels at depth. The ASWQS specifies an (undefined) average value of 5 mg/l as that needed for compliance. It is noted that any type of reasonable average for the data recovered will result in compliance.

3.1.6 pH Measurements

Table 3-3 summarizes the pH readings obtained during the study. There are small differences observed along the harbor axis, but no distinct trends. Surface values are slightly lower than those at depth. No effect of the discharge can be observed.

Measured pH values appear to meet the ASWQS numerical standard at all locations. [The ASWQS is the "*The pH range shall be 6.5 to 8.6 and be within 0.2 pH unit of that which would occur naturally.*"] The natural value for marine waters is generally considered to be in the range of 7.5 to 8.4. For near surface waters (water in equilibrium with atmospheric CO_2), pH is typically about 8.1 to 8.2. Variability in coastal waters will be more extreme and freshwater inflows will tend to depress the natural values.

During the study, it was observed that the pH values being recorded by the profiling instrument appeared consistently lower than expected. Calibration of the instrument in the field was considered but determined to be not feasible. Therefore, pH of surface samples was measured with a calibrated pH meter and compared to the readings at the surface from the profiling instrument and a correction was developed and applied to the profile data. The details of this process are provided in Appendix IV.

3.1.7 Secchi Depth

Secchi depths are presented in Table 2-1 above. The values recorded show a trend, increasing from the inner harbor to the outer harbor as would be expected. This trend is somewhat confused by the differences in time of day, and thus sun angle and diurnal variations in water clarity. In addition, it must be noted, the times of data collection were almost entirely during complete or nearly complete overcast sky conditions and thus Secchi depths will be substantially understated compared to those collected under standard clear sky conditions. The Secchi depths observed in the inner harbor range from 15 to 20 feet. The Secchi depth was 15 feet at Station 13 which is the inner most station, in a total water depth of about 29 feet.

The ASWQS is in terms of light penetration, which cannot be directly converted from Secchi or turbidity readings. However, some estimates can be made with light penetration being estimated by Secchi depth using the following approximation:

$$\chi = \kappa \cdot D^{-1}$$

where

χ = extinction coefficient for visible light

κ = a constant

and

D = Secchi depth in meters for a 30 cm Secchi disk.

The constant κ is not easily determined but is often taken as 1.7 based on data from the English Channel (Sverdrup, 1942). Using the above approximation, the depth of light penetration of 1 percent corresponds to a Secchi depth of 24 feet. Such a calculation corresponds to Secchi readings taken at high sun angles and in full sun light. As pointed out above, this was not possible during times of data collection in November 1996. The corresponding depth under conditions during measurements at this time is likely less than half that calculated above, based on a review of previous data.

The ASWQS state that light penetration of 1 percent of the incident light should penetrate to a depth of 65 feet 50 percent of the time. As calculated above this corresponds to Secchi depth of approximately 24 feet (under appropriate conditions). The data can not be directly used to evaluate compliance in this case, however expedience and judgment would indicate that ASWQS for light penetration are being satisfied throughout the harbor.

3.2 NUTRIENT AND BIOLOGICAL PARAMETERS

Parameters to evaluate potential impacts of biological productivity included nutrients and chlorophyll-a. Nutrients included total phosphorus, total Kheldal nitrogen (TKN), ammonia nitrogen, nitrate plus nitrite, and nitrite nitrogen. ASWQS apply to total nitrogen (TN) which was calculated by adding the nitrogen components, noting that ammonia is included in TKN. Table 2-2 above indicates the nutrient constituents measured and the methods used in the laboratory. Samples were prepared for chlorophyll-a analysis by filtering 2 liters of water through a filter (see Table 2.2) using a vacuum pump apparatus. The filters were treated with manganese sulfate as a preservative, frozen, and then sent to the laboratory for analysis.

The laboratory used for the analyses was AMTEST, located in Redmond, WA. Samples were stored on ice in American Samoa and shipped on ice via DHL to the laboratory. Laboratory chain of custody forms and results are provided in Appendices IV and V, respectively. Each of the nutrient and parameters are discussed below based on the data summarized in Table 3-4.

3.2.1 Total Nitrogen

The numerical standard (median value) for total nitrogen (TN) is 200 μg/l. Of the 100 measurements 1 was above this value. A TN of approximately 266 was recorded at Station 11A in the inner harbor at a depth of 30 feet. The next highest value was 178 at station 8A at a depth of 60 feet, which is inside the mixing zone. The ASWQS for TN is met throughout the harbor at the time of sampling.

3.2.2 Total Phosphorus

The numerical standard for total phosphorus (median value) is 30 μg/l. As shown in Table 3-4, a total 4 of the 100 measurements were above this value. At Station 9 there were two measurements reported at 31 μg/l at depths of 30 and 60 feet (a concentration of 30 μg/l was reported at 90 feet). The median value at this station was 30 μg/l. At station 8A TP concentrations of 62 and 65 μg/l were reported at 30 and 60 feet, respectively. Station 8A is within the mixing zone and the median value at this station was between 17 and 23 μg/l. The ASWQS for TP is met throughout the harbor at the time of sampling.

3.2.3 Chlorophyll-a

The numerical standard (median) for chlorophyll-a is 1 μg/l. Fourteen (14) of the 20 stations exhibited chlorophyll-a values higher than 1.0 μg/l. In every case the higher values were in the upper portion of the water column, typically at the near surface and 30 foot depths (see Table 3-4). At 9 of the 14 stations the median at was at or below the ASWQS of 1.0 μg/l. Of the remaining stations two (12 and 13) are in the inner harbor which typically has higher levels, only one is on the mixing zone boundary (17), and two are in the outer harbor (6A and 7). The median value for the harbor was less than 1.0 μg/l and the median value for each station was below 1.0 μg/l except as noted above.

It appears that many of the elevated values could be attributable to runoff through Pago Pago Creek, and other streams around the harbor. Examination of the other water column constituents provides no evidence that the elevated values of chlorophyll-a are attributable to the JCO discharge. Overall, regardless of the higher values in certain locations, the ASWQS appear to be met throughout the harbor with the possible exception of the far inner harbor, which is attributable to causes other than the JCO discharge as mentioned above, and a small portion of the outer harbor, not within the mixing zone.

3.3 Zinc and Copper Concentrations

Zinc and copper were measured at specified stations and depths. Samples were collected and preserved as described above and in the SAP/SOP (Appendix II). Table 3-5 summarizes the results of the metals analyses. The chain of custody forms and laboratory results are provided in Appendices IV and VI, respectively. All analyses resulted in reported values less than detection limits. The reason for conducting these analyses is to provide receiving water data for the assessment of a mixing zone for these two metals. The data for both zinc and copper were adequate for this purpose with values of <20 μg/l and < 2 μg/l as requested and well below the water quality criteria.

Table 3-1.a
Summary of Temperature Measurements (°C)
from Continuous Vertical Profiles
Pago Pago Harbor Water Quality Modeling
23 November 1996

Station	Maximum	Minimum	Average	Standard Deviation
Transition Zone				
5	28.63	27.97	28.21	0.18
5A	28.88	28.18	28.30	0.16
Outer Harbor				
6	29.06	27.87	28.19	0.26
6A	29.48	28.21	28.39	0.22
7	29.04	28.03	28.31	0.22
Mixing Zone - Interior				
8	28.55	28.03	28.31	0.15
8A	28.52	28.00	28.25	0.16
14	28.53	28.00	28.28	0.16
Mixing Zone - Edge				
15	28.49	28.17	28.32	0.09
16	29.19	27.99	28.26	0.23
17	28.68	28.13	28.36	0.12
18	28.62	28.01	28.24	0.16
Middle Harbor				
9	29.26	28.14	28.38	0.23
9A	29.34	28.24	28.42	0.23
10	29.31	28.01	28.33	0.30
10A	28.95	28.19	28.36	0.20
Inner Harbor				
11	29.05	28.02	28.31	0.19
11A	29.04	28.05	28.36	0.24
12	29.10	28.07	28.31	0.23
13	29.56	28.39	28.65	0.32

Table 3-1.b
Summary of Salinity Measurements (PSU)
from Continuous Vertical Profiles
Pago Pago Harbor Water Quality Modeling
23 November 1996

Station	Maximum	Minimum	Average	Standard Deviation
Transition Zone				
5	35.70	35.36	35.63	0.05
5A	35.66	35.20	35.60	0.08
Outer Harbor				
6	35.73	35.02	35.62	0.13
6A	35.64	35.26	35.60	0.08
7	35.68	34.52	35.52	0.23
Mixing Zone - Interior				
8	35.67	34.83	35.56	0.14
8A	35.66	34.75	35.59	0.11
14	35.66	34.80	35.58	0.12
Mixing Zone - Edge				
15	35.64	34.35	35.56	0.21
16	35.73	34.99	35.61	0.12
17	35.64	35.25	35.57	0.08
18	35.67	34.65	35.57	0.17
Middle Harbor				
9	35.62	34.69	35.53	0.17
9A	35.64	34.94	35.54	0.15
10	35.68	35.03	35.58	0.14
10A	35.64	35.10	35.55	0.11
Inner Harbor				
11	35.65	34.67	35.56	0.13
11A	35.66	34.71	35.50	0.21
12	35.60	34.66	35.51	0.13
13	35.53	34.42	35.35	0.23

Table 3-1.c Summary of Sigma-t Measurements from Continuous Vertical Profiles Pago Pago Harbor Water Quality Modeling 23 November 1996				
Station	**Maximum**	**Minimum**	**Average**	**Standard Deviation**
Transition Zone				
5	22.93	22.46	22.80	0.10
5A	22.84	22.26	22.75	0.11
Outer Harbor				
6	22.97	22.07	22.80	0.18
6A	22.81	22.14	22.72	0.13
7	22.90	21.72	22.69	0.24
Mixing Zone - Interior				
8	22.87	22.10	22.72	0.14
8A	22.89	22.05	22.76	0.12
14	22.90	22.09	22.74	0.13
Mixing Zone - Edge				
15	22.82	21.77	22.71	0.18
16	22.94	21.99	22.77	0.17
17	22.83	22.37	22.71	0.09
18	22.89	21.93	22.75	0.17
Middle Harbor				
9	22.80	21.74	22.67	0.20
9A	22.80	21.91	22.66	0.19
10	22.91	22.00	22.72	0.21
10A	22.82	22.16	22.69	0.15
Inner Harbor				
11	22.88	21.80	22.72	0.16
11A	22.84	21.83	22.65	0.23
12	22.81	21.83	22.65	0.23
13	22.67	21.44	22.45	0.28

Table 3-1.d Summary of Turbidity Measurements (NTU) from Continuous Vertical Profiles Pago Pago Harbor Water Quality Modeling 23 November 1996				
Station	**Maximum**	**Minimum**	**Average**	**Standard Deviation**
		Transition Zone		
5	1.07	0.12	0.37	0.20
5A	0.65	0.13	0.22	0.11
		Outer Harbor		
6	0.93	0.15	0.42	0.20
6A	1.42	0.27	0.51	0.24
7	1.72	0.39	0.75	0.35
		Mixing Zone - Interior		
8	4.74	0.18	0.73	0.53
8A	14.04	0.38	1.75	2.74
14	3.49	0.23	0.96	0.77
		Mixing Zone - Edge		
15	6.29	0.38	1.03	0.55
16	3.40	0.16	0.64	0.55
17	2.08	0.42	0.84	0.27
18	5.17	0.20	0.94	0.72
		Middle Harbor		
9	1.60	0.38	0.81	0.31
9A	2.80	0.34	0.78	0.31
10	6.23	0.31	0.64	0.48
10A	1.73	0.32	0.50	0.15
		Inner Harbor		
11	2.74	0.25	0.83	0.52
11A	3.17	0.43	0.99	0.65
12	2.42	0.64	1.21	0.47
13	9.48	0.92	1.86	1.07

Table 3-2
Results of Laboratory Analyses of Turbidity for Selected Stations
Pago Pago Harbor Water Quality Monitoring
November 1996

	Turbidity at Station Depths Indicated (NTU)							
Depth (feet)[1]	**S**	**30**	**60**	**90**	**120**	**B**	**Average**	**Median**
Stations								
Mixing Zone Interior								
8	0.10	0.09	0.05	0.01	<0.01	<0.01	0.05	0.01 - 0.05
8A	0.11	0.24	0.27	0.03	<0.01	0.07	0.12	0.07 - 0.11
14	0.14	0.15	0.07	0.04	0.05	0.11	0.09	0.07 - 0.11
ZOM Boundary								
15[2]	0.20	0.09	0.03	-	-	0.06	0.10	0.06 - 0.09
16	0.18	0.11	0.12	0.08	0.16	0.20	0.14	0.12 - 0.16
17[3]	0.19	0.22	-	-	-	0.21	0.21	0.21
18	0.13	0.43	0.14	0.08	0.08	0.13	0.17	0.13 - 0.14

Notes:
[1] S = Near Surface (within 1 meter of the surface); B= Near Bottom (within 1 meter of the bottom)
[2] Station 15 sampled at only four depths as shown
[3] Stations 17 sampled at only three depths as shown.

Table 3-3
Dissolved Oxygen and pH measurements
Pago Pago Harbor Water Quality Monitoring - November 1996

Station	Depth	DO (mg/l)	pH (SU)[1]	Station	Depth	DO (mg/l)	pH (SU)[1]
5	SURF	5.5	***8.36***	10A	SURF	5.8	8.35
	30	5.6	***8.28***		30	5.3	8.35
	60	5.7	***8.34***		60	5.3	8.35
	90	5.8	***8.30***		90	5.2	8.35
	120	5.9	***8.29***		BOTM	5.2	8.35
	BOTM	5.9	***8.28***				
5A	SURF	5.6	***8.26***	11	SURF	7.9	8.37
	30	5.6	***8.36***		30	7.4	8.36
	60	5.6	***8.33***		60	7.0	8.35
	90	5.4	***8.32***		90	7.2	8.36
	120	5.5	***8.29***		120	6.8	8.35
	BOTM	5.4	***8.23***		BOTM	6.4	8.35
6	SURF	5.0	***8.38***	11A	SURF	7.7	8.37
	30	5.1	***8.41***		30	7.4	8.35
	60	5.0	***8.42***		60	6.8	8.34
	90	4.9	***8.40***		90	7.0	8.34
	120	4.8	***8.45***		BOTM	6.5	8.34
	BOTM	4.7	***8.45***				
6A	SURF	5.1	***8.43***	12	SURF	7.7	8.35
	30	5.1	***8.38***		30	6.8	8.32
	60	5.1	***8.38***		BOTM	6.6	8.32
	BOTM	5.0	***8.41***				
7	SURF	5.1	***8.36***	13	SURF	7.9	8.35
	30	4.6	***8.34***		15	7.1	8.30
	60	5.1	***8.32***		BOTM	6.4	8.21
	90	5.2	***8.28***				
	BOTM	5.2	***8.38***				
8	SURF	5.4	***8.42***	14	SURF	5.4	***8.44***
	30	5.1	***8.44***		30	5.1	***8.43***
	60	5.0	***8.36***		60	4.6	***8.40***
	90	4.9	***8.37***		90	4.8	***8.42***
	120	4.9	***8.41***		120	5.0	***8.39***
	BOTM	5.1	***8.39***		BOTM	4.6	***8.35***
8A	SURF	5.4	***8.39***	15	SURF	5.3	8.22/***8.07***
	30	5.1	***8.37***		30	5.1	8.27/***8.29***
	60	5.0	***8.32***		60	5.0	8.29/***8.28***
	90	5.1	***8.37***		BOTM	4.8	8.28/***8.09***
	120	4.9	***8.36***				
	BOTM	4.8	***8.35***				
9	SURF	6.1	8.33	16	SURF	5.6	8.34/***8.38***
	30	4.9	8.30		30	5.3	8.28/***8.41***
	60	5.0	8.28		60	5.2	8.27/***8.41***
	90	4.6	8.28		90	5.3	8.30/***8.20***
	BOTM	5.1	8.30		120	5.5	8.31/***8.43***
					BOTM	4.6	8.30/***8.21***
9A	SURF	6.0	8.30	17	SURF	4.9	***8.43***
	30	6.5	8.29		30	5.0	***8.48***
	60	6.0	8.28		BOTM	4.3	***8.36***
	90	5.9	8.26				
	BOTM	6.2	8.18				
10	SURF	6.0	8.30	18	SURF	5.3	***8.31***
	30	5.9	8.32		30	5.1	***8.35***
	60	5.9	8.32		60	5.1	***8.34***
	90	5.8	8.34		90	5.1	***8.37***
	120	5.4	8.34		120	5.1	***8.36***
	BOTM	5.4	8.35		BOTM	4.9	***8.34***

[1] pH values shown in ***bold italic*** were measured in chlorophyll-a samples during filtering, others were measured in the field as samples were collected.

Table 3-4
Nutrients and Chlorophyll-a Measurements
Pago Pago Harbor Water Quality Monitoring
November 1996

Station	Depth	Chlorophyll-a (mg/m^3)	Ammonia Nitrogen (mg/l)	TKN (mg/l)	Nitrate + Nitrite (mg/l)	Nitrite Nitrogen (mg/l)	Total Phosphorus (mg/l)
5	SURF	0.25	<0.005	0.028	<0.01	<0.001	0.009
5	30	0.22	<0.005	<0.025	<0.01	<0.001	0.009
5	60	0.48	<0.005	0.049	<0.01	<0.001	0.014
5	90	0.59	<0.005	0.066	<0.01	<0.001	<0.005
5	120	0.12	<0.005	0.092	<0.01	0.002	0.011
5	BOTM	0.12	<0.005	0.028	<0.01	0.009	0.013
5A	SURF	0.34	<0.005	0.071	<0.01	<0.001	0.005
5A	30	0.59	<0.005	0.060	<0.01	<0.001	0.013
5A	60	0.71	<0.005	0.093	<0.01	<0.001	0.012
5A	90	0.49	<0.005	0.043	<0.01	<0.001	0.011
5A	120	0.47	<0.005	<0.025	<0.01	<0.001	0.009
5A	BOTM	0.36	<0.005	<0.025	<0.01	0.009	0.010
6	SURF	1.8	<0.005	0.063	<0.01	0.001	0.008
6	30	2.0	<0.005	0.097	<0.01	0.001	0.016
6	60	0.96	<0.005	0.029	<0.01	0.002	0.009
6	90	0.57	<0.005	<0.025	<0.01	0.005	0.014
6	120	0.34	<0.005	0.039	<0.01	0.010	0.007
6	BOTM	0.48	<0.005	0.047	<0.01	0.009	0.010
6A	SURF	1.3	<0.005	0.039	<0.01	<0.001	0.009
6A	30	1.6	<0.005	0.10	<0.01	<0.001	0.009
6A	60	1.5	<0.005	0.068	<0.01	<0.001	0.012
6A	BOTM	0.78	<0.005	<0.025	<0.01	<0.001	0.009
7	SURF	1.6	<0.005	<0.025	<0.01	<0.001	0.019
7	30	1.3	0.005	0.035	0.012	0.012	0.020
7	60	1.1	<0.005	0.028	<0.01	0.005	0.016
7	90	1.3	<0.005	0.12	<0.01	0.003	0.016
7	BOTM	0.61	<0.005	0.051	<0.01	0.003	0.024
8	SURF	2.0	<0.005	<0.025	<0.01	<0.001	0.014
8	30	2.7	<0.005	<0.025	<0.01	0.001	<0.005
8	60	0.85	0.006	0.040	<0.01	0.011	0.027
8	90	0.59	<0.005	<0.025	<0.01	0.003	<0.005
8	120	0.36	<0.005	<0.025	<0.01	0.003	0.022
8	BOTM	0.59	<0.005	<0.025	<0.01	0.003	<0.005
8A	SURF	1.2	<0.005	0.031	<0.01	<0.001	0.023
8A	30	1.9	0.10	0.15	<0.01	0.006	0.062
8A	60	0.96	0.10	0.17	<0.01	0.008	0.065
8A	90	0.60	<0.005	<0.025	<0.01	0.003	0.017
8A	120	0.35	<0.005	<0.025	<0.01	0.004	0.016
8A	BOTM	0.24	<0.005	<0.025	0.014	0.022	0.013
9	SURF	0.35	<0.005	<0.025	<0.01	0.017	0.022
9	30	0.53	0.009	0.047	<0.01	<0.001	0.031
9	60	0.37	0.01	<0.025	0.022	0.030	0.031
9	90	0.36	0.008	0.056	0.031	0.029	0.030
9	BOTM	0.34	<0.005	<0.025	0.013	0.016	0.024
9A	SURF	0.82	<0.005	<0.025	<0.01	0.001	0.018
9A	30	0.80	<0.005	<0.025	<0.01	0.018	0.022
9A	60	0.37	<0.005	<0.025	<0.01	0.027	0.026
9A	90	0.34	<0.005	<0.025	0.016	0.005	0.019
9A	BOTM	0.31	<0.005	<0.025	<0.01	0.002	0.019

Table 3-4 - continued							
Station	**Depth**	**Chlorophyll-a (mg/m^3)**	**Ammonia Nitrogen (mg/l)**	**TKN (mg/l)**	**Nitrate + Nitrite (mg/l)**	**Nitrite Nitrogen (mg/l)**	**Total Phosphorus (mg/l)**
10	SURF	0.74	<0.005	<0.025	<0.01	<0.001	0.013
10	30	0.69	<0.005	0.030	<0.01	0.007	0.019
10	60	0.47	<0.005	0.062	<0.01	0.009	0.012
10	90	0.48	<0.005	0.030	<0.01	0.004	0.012
10	120	0.59	<0.005	<0.025	<0.01	0.014	0.014
10	BOTM	0.49	<0.005	<0.025	<0.01	<0.001	0.014
10A	SURF	0.36	<0.005	<0.025	<0.01	0.002	0.014
10A	30	0.69	<0.005	<0.025	<0.01	0.007	0.018
10A	60	0.47	<0.005	<0.025	<0.01	0.003	0.011
10A	90	0.61	<0.005	<0.025	<0.01	0.007	0.012
10A	BOTM	0.50	<0.005	<0.025	<0.01	0.007	0.014
11	SURF	1.8	<0.005	<0.025	<0.01	0.002	0.014
11	30	1.1	<0.005	<0.025	<0.01	0.006	0.011
11	60	0.98	<0.005	<0.025	0.011	0.021	0.012
11	90	0.43	<0.005	0.029	<0.01	0.008	<0.005
11	120	0.29	<0.005	<0.025	<0.01	0.024	<0.005
11	BOTM	0.41	<0.005	<0.025	0.014	0.026	0.019
11A	SURF	1.7	<0.005	<0.025	<0.01	0.002	<0.005
11A	30	1.4	<0.005	0.26	<0.01	0.006	<0.005
11A	60	0.60	<0.005	0.13	0.019	0.023	0.011
11A	90	0.61	<0.005	0.049	<0.01	0.011	0.011
11A	BOTM	0.24	<0.005	0.037	0.018	0.027	0.016
12	SURF	1.9	<0.005	0.050	<0.01	0.003	0.010
12	30	1.0	<0.005	0.034	0.011	0.013	0.018
12	BOTM	0.35	<0.005	0.056	0.027	0.033	0.010
13	SURF	3.7	<0.005	0.070	0.024	0.002	0.025
13	15	1.4	<0.005	<0.025	<0.01	0.005	0.014
13	BOTM	1.2	<0.005	<0.025	<0.01	0.013	0.016
14	SURF	1.8	<0.005	<0.025	<0.01	0.002	0.009
14	30	2.6	<0.005	<0.025	<0.01	0.004	<0.005
14	60	0.48	0.016	0.042	0.011	0.013	0.017
14	90	0.60	<0.005	<0.025	<0.01	0.006	<0.005
14	120	0.12	<0.005	<0.025	<0.01	0.013	<0.005
14	BOTM	0.12	<0.005	0.038	<0.01	0.021	0.021
15	SURF	1.8	<0.005	<0.025	<0.01	0.002	0.016
15	30	1.2	<0.005	<0.025	<0.01	0.009	0.018
15	60	0.84	<0.005	<0.025	<0.01	0.013	0.014
15	BOTM	0.49	0.015	0.031	0.029	0.028	0.020
16	SURF	1.4	<0.005	<0.025	<0.01	0.002	0.017
16	30	1.6	<0.005	<0.025	<0.01	0.003	<0.005
16	60	0.24	<0.005	0.033	<0.01	0.004	0.009
16	90	0.48	<0.005	<0.025	<0.01	0.001	<0.005
16	120	1.2	<0.005	<0.025	<0.01	<0.001	0.011
16	BOTM	0.12	<0.005	<0.025	0.017	0.028	0.018
17	SURF	1.1	<0.005	<0.025	<0.01	<0.001	0.013
17	30	2.0	<0.005	<0.025	<0.01	<0.001	0.018
17	BOTM	0.74	0.044	0.12	<0.01	0.012	0.048
18	SURF	1.7	<0.005	<0.025	<0.01	<0.001	0.010
18	30	1.5	0.009	0.049	<0.01	0.010	0.020
18	60	1.3	<0.005	<0.025	<0.01	0.006	0.019
18	90	0.73	<0.005	<0.025	<0.01	0.004	0.018
18	120	0.48	<0.005	<0.025	<0.01	0.010	0.026
18	BOTM	0.24	<0.005	<0.025	0.012	0.022	0.015

Table 3-5 Zinc and Copper Analysis Results Pago Pago Harbor Water Quality Monitoring November 1996			
Station	**Depth**	**Zinc Concentration (μg/l)**	**Copper Concentration (μg/l)**
Transition Zone			
5	30	<20	<2
	120	<20	<2
	Near Bottom	<20	<2
5A	30	<20	<2
	120	<20	<2
	Near Bottom	<20	<2
Inner Harbor			
11	30	<20	<2
	120	<20	<2
	Near Bottom	<20	<2
13	Near Surface	<20	<2
	Near Bottom	<20	<2
ZOM Boundary			
15	30	<20	<2
	120	<20	<2
	Near Bottom	<20	<2
16	30	<20	<2
	120	<20	<2
	Near Bottom	<20	<2
18	30	<20	<2
	120	<20	<2
	Near Bottom	<20	<2

4. CONCLUSIONS AND RECOMMENDATIONS

The second semiannual Receiving Water Quality Monitoring study was successfully completed with only minor deviations from the SAP/SOP. The data indicate compliance with ASWQS throughout the harbor. The water quality standards are based on median values of many constituent concentrations, and the standards were fully achieved on this basis. The numerical criteria, on which the standards are based, are occasionally exceeded at individual stations (although this does not necessarily mean water quality standards are violated). However, in no instance outside the mixing zone, can the individual excursions above the criteria be attributed to the JCO discharge. The canneries are in compliance with the applicable conditions of the NPDES permits.

Other than specific points described in the report, no general recommendations are made for conducting future sampling episodes of water quality monitoring. Summarizing specific points for detailed field and laboratory work the following recommendation is made, and will be followed in the future:

> The turbidity sensor should be more rigorously tested, if possible to determining the actual instrument offset and resolution for reasons described in Section 3. Until we are confident of the performance of the sensor, supplementary samples should continue to be designated for turbidity testing in the laboratory. Locations should be at the mixing zone boundary (Stations 15,16,17, and 18) and background (Stations 5 and 5A). Concurrent with the "dock side" verification testing for other profiling instruments, the readings from the turbidity sensor should be examined before and after the sampling and profiling.

5. REFERENCES

CH2M HILL, 1991. Engineering and Environmental Feasibility Evaluation of Waste Disposal Alternatives. Prepared for StarKist Samoa, Final Report, March 1991.

CH2M HILL and Glatzel and Associates, 1995. Results of March 1995 Harbor Water Quality Monitoring, Pago Pago American Samoa.

CH2M HILL and **gdc**, 1997. Receiving Water Quality Monitoring Report: Pago Pago Harbor, American Samoa: March 1996 Sampling. 6 March 1996.

D&A Instrument Company, 1991. Instruction manual: OBS-1 & 3 Suspended Solids & Turbidity Monitor. Port Townsend, WA Revised March 1991.

Environmental Protection Agency, Region 10, 1992. Authorization to Discharge Under the National Pollution Discharge Elimination System; Permit No. AS0000019, Issued to StarKist Samoa, Inc., 24 September 1992.

Environmental Protection Agency, Region 10, 1992. Authorization to Discharge Under the National Pollution Discharge Elimination System; Permit No. AS0000027, Issued to VCS Samoa packing Company, 24 September 1992.

Environmental Protection Agency, Region 10, 1992. Modification of Receiving Water Qaulity Monitoring Requirements of NPDES Permit AS000019 for StarKist Samoa, Inc. and NPDES Permit AS0000027 for VCS Samoa Packing Company. November 8, 1995.

Sea-Bird Electronics, Inc., 1993. CDT Data Acquisition Software: SEASOFT, Version 4.026. Bellevue, WA, May 1993.

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Appendix I

USEPA Permit Modification for Receiving Water Quality Monitoring

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

NOV 08 1995

Norman Wei
Corporate Environmental Manager
StarKist Foods, Inc.
1054 Ways Street
Terminal Island, CA 90731

James L. Cox
Director of Engineering
and Environmental Affairs
Van Camp Seafood Company, Inc.
4510 Executive Drive, Suite 300
San Diego, CA 92121-3029

Subject: Modification of Receiving Water Quality Monitoring Requirements of NPDES Permit AS0000019 for StarKist Samoa, Inc. and NPDES Permit AS0000027 for VCS Samoa Packing Company

Dear Mr. Wei and Mr. Cox:

The U.S. Environmental Protection Agency (EPA) Region IX is modifying the receiving water quality monitoring program for the above-referenced National Pollutant Discharge Elimination System (NPDES) Permits AS0000019 and AS0000027, as per 40 CFR 122, effective November 10, 1995. Based on review of the water quality data collected under this permit, it appears that the American Samoa water quality standards for constituents monitored under the NPDES permits for the canneries are generally being met throughout Pago Pago Harbor, except in the inner harbor and ocassionally in the zone of mixing for the joint cannery outfall. It is surmised that the inner harbor exceedances may not be attributable to the canneries' discharge and the revised monitoring program will provide data to better define the causes for any noncompliance with water quality standards.

This modification to the receiving water quality monitoring program is considered a minor modification as the overall monitoring effort required is not being reduced. The purpose of the original monthly monitoring program was to assess the short-term effects of the canneries' discharge at the new outfall location. Over the past three years, sufficient data has been collected and reviewed for this purpose. The monitoring program is now being revised to assess the long-term effects of the discharge to the harbor. Changes are being made in monitoring frequency (from monthly to semi-annually to cover both oceanographic seasons), and in sampling types (from grab to continuous vertical profiles) for some parameters. Three new sampling stations are being required as well as monitoring for two additional parameters (zinc and copper) at certain stations.

Additional sampling for zinc and copper is being required to establish ambient background levels in the harbor which will be used to determine the applicability of establishing mixing zones for these constituents. Elevated zinc and copper effluent levels have been noted and significant reductions in source loadings would be very difficult, for reasons cited in the "Metals Source Identification Study for Samoa Packing", dated June 15, 1995.

The changes to the receiving water monitoring program are detailed in the attached pages. (Shaded text indicates additions to the permit. Lined out items are deletions.) These replace the corresponding pages in the permit and are hereby incorporated into and made a part of both Permits AS0000019 and AS0000027. In summary, the changes are as follows:

1. The frequency of sampling is reduced from monthly to semi-annually (corresponding with other sampling events required by the permit: effluent priority pollutant, toxicity and sediment monitoring);

2. The number of sampling stations is increased by three, from 17 to 20, and will be located as follows: on the western side of the middle harbor (American Samoa Power Authority Station B), outer harbor (new Station 6A), and transition zone (new Station 5A).

3. Continuous vertical profiles will be performed, rather than discrete samples, for temperature, salinity (conductivity), dissolved oxygen, pH, and turbidity.

4. Six, rather than three samples will be taken per station where possible, for nutrients and chlorophyll-a. Three samples will be taken at depths currently specified (near surface, 60 feet and near bottom), and three additional samples will be taken at 30, 90 and 120 feet. A minimum of three samples will be taken at each station (near surface, mid-depth and near bottom).

5. Suspended solids is removed from the suite of constituents to be analyzed.

6. Sampling for zinc and copper will be required and conducted at the same frequency as for the revised water quality monitoring program (approximately every six months). Sampling locations will be at the boundary of the existing mixing zone established for total nitrogen and total phosphorus, in the transition zone and in the inner harbor. Stations and depths to be sampled are as follows:

Stations	**Depths**
15, 16, 18, 5, 5A	30 ft., 120 ft., near bottom
11, 13	near surface, near bottom

The number of stations and samples may be adjusted based on the results of the first sampling episode.

7. A standard operating procedure and study plan for the revised water quality monitoring program will be developed and submitted within 30 days of the effective date of this revision for approval.

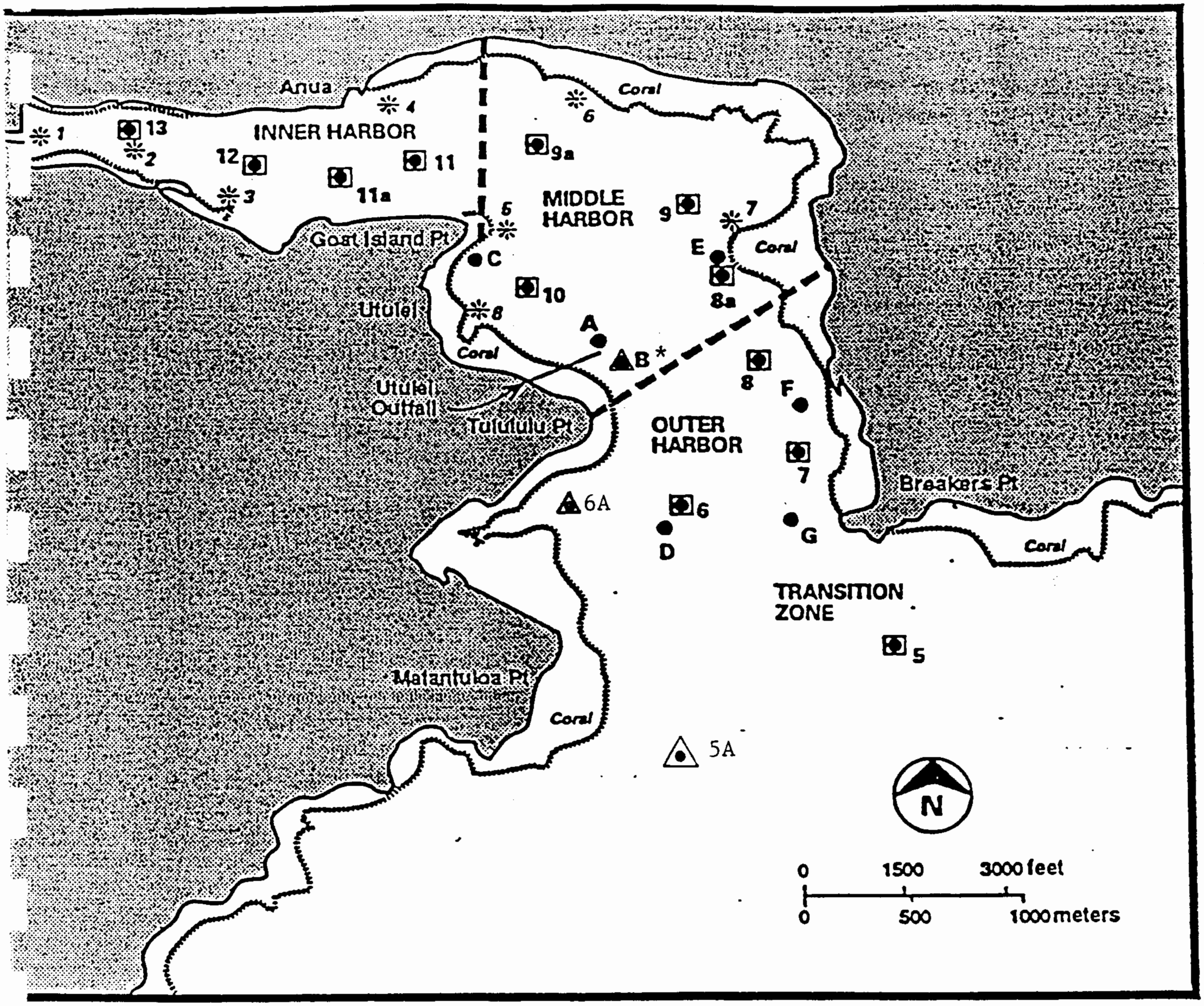
A copy of this letter and the revised pages of the permit should be attached to the current NPDES permit and kept at the respective facility's file for compliance purposes. Should you have any questions regarding this action, please call Pat Young, American Samoa Program Manager at (415) 744-1594 or Doug Liden of my staff at (415) 744-1920.

Sincerely,

Terry Oda
Chief, Permits Section
Water Management Division

Enclosures

cc: Steve Costa, CH2M HILL
Togipa Tausaga/Sheila Wiegman, ASEPA
Barry Mills, StarKist Samoa, Inc.
William D. Perez, VCS Samoa Packing Company



LEGEND

- ASG Sampling Station
- Utulei WWTP Station
- CH2M HILL Field Measurement Station (1/19/91)
- New sampling station as per permit modifications, effective 11/10/95.
- * ASPA Station B will be utilized and referred to as Station 10A.

REVISED **FIGURE 2. LOCATION OF WATER QUALITY STATIONS IN PAGO PAGO HARBOR**

Revised effective November 10, 1995

Monitoring stations shall be designated and located as shown (also see Figures 1 and 2-revised):

Offshore Station	Vicinity	Location	Coordinates ~~Latitude~~ West Longitude		~~Longitude~~ South Latitude	
5	Transition Zone		170° 39' 44.282"	~~.72W~~	14° 17' 53.468"	~~.88S~~
5A	Transition Zone	West	170° 40' 13.000"		14° 18' 29.000"	
6	Outer harbor	Central	170° 40' 11.372"	~~.20W~~	14° 17' 31.322"	~~.52S~~
6A	Outer harbor	West	170° 40' 18.500"		14° 17' 31.000"	
7	Outer harbor	East, S.	170° 39' 56.256"	~~.93W~~	14° 17' 22.339"	~~.37S~~
8	Outer harbor	East	170° 39' 53.960"	~~40'.07W~~	14° 17' 10.830"	~~.17S~~
8a	Middle harbor	East	170° 40' 5.529"	~~.13W~~	14° 16' 51.575"	~~.88S~~
9	Middle harbor	East	170° 40' 9.006"	~~.18W~~	14° 16' 39.561"	~~.66S~~
9a	Middle harbor	East	170° 40' 34.862"	~~.57W~~	14° 16' 34.905"	~~.58S~~
10	Middle harbor	West	170° 40' 39.508"	~~.75W~~	14° 16' 55.258"	~~.87S~~
10A	Middle harbor	West	170° 40' 20.000"		14° 17' 10.000"	
11	Inner harbor	Center, E.	170° 40' 54.092"	~~.90W~~	14° 16' 34.295"	~~.58S~~
11a	Inner harbor	Center, E.	170° 41' 6.540"	~~.13W~~	14° 16' 38.573"	~~.62S~~
12	Inner harbor	Center	170° 41' 20.769"	~~.33W~~	14° 16' 36.564"	~~.60S~~
13	Inner harbor	Center, W.	170° 41' 42.849"	~~.71W~~	14° 16' 30.008"	~~.50S~~
14	Middle harbor	Diffuser	170° 40' 1.678"	~~.03W~~	14° 16' 58.934"	~~.58S~~
15	Middle harbor	ZOM Edge, N.	170° 40' 6.243"	~~.12W~~	14° 16' 45.692"	~~.77S~~
16	Middle harbor	ZOM Edge, W.	170° 40' 13.483"	~~.17W~~	14° 16' 57.273"	~~.56S~~
17	Middle harbor	ZOM Edge, E.	170° 40' 1.158"	~~39'.91W~~	14° 16' 54.398"	~~.90S~~
18	Outer harbor	ZOM Edge, S.	170° 39' 59.177"	~~40'.08W~~	14° 17' 8.862"	~~.10S~~

Note: Revised coordinates listed are locations of stations used and reported in CH2M Hill's July 7, 1995 Report, "Results of March 1995 Harbor Water Quality Monitoring Pago Pago Harbor, American Samoa", and are as read from GPS in field. (A correction factor based on readings at known locations may be required for exact station location.) Latitudes for Stations 14 and 16 originally listed in the permit were incorrect and are corrected here.

It is recommended that the stations be located using the sextant angle resection positioning method or a positioning system which affords an equivalent degree of accuracy and precision. Other means may be used if, in the judgment of ASEPA and EPA Region 9, they are of sufficient accuracy and precision to allow reoccupation of the stations within plus or minus six (6) meters.

The following shall constitute the Water Quality Monitoring Program as shown:

Parameter	Units	Stations	Sample Type		Sample Frequency	
Temperature	°F	all	~~grab~~	continuous (1)	~~monthly~~	semi-annual (2)
pH		"	"	continuous (1)	"	semi-annual (2)
Dissolved Oxygen	mg/l	"	"	continuous (1)	"	semi-annual (2)
~~Suspended Solids~~	~~mg/l~~	~~"~~	~~"~~		~~"~~	
Light Penetration	ft.	"	grab		"	semi-annual (2)
Turbidity	NTU	"	"	continuous (1)	"	semi-annual (2)
Salinity	ppt	"	"	continuous (1)	"	semi-annual (2)
Chlorophyll a (3)	µg/l	"	grab		"	semi-annual (2)
Total Nitrogen (3)	µg/l	"	"		"	semi-annual (2)
Total Phosphorus (3)	µg/l	"	"		"	semi-annual (2)
Total Ammonia (3)	µg/l	"	"		"	semi-annual (2)
Zinc	µg/l	(4)	"			semi-annual (2)
Copper	µg/l	(4)	"			semi-annual (2)

(1) Continuous vertical profiles.

(2) Sampling to occur approximately every 6 months to coincide with the two main oceanographic seasons.

(3) Samples to be taken at the following depths where possible: near surface, 30, 60, 90 and 120 feet, and near bottom. Where water depth is less than 120 feet, a minimum of three samples shall be taken at each station (near surface, mid-depth and near bottom).

(4) The following stations shall be sampled at the noted depths:
Stations 5, 5A, 15, 16 18: 30 feet, 120 feet, near bottom;
Stations 11 and 13: near surface and near bottom.
The number of stations and samples may be adjusted based on the results of the first sampling episode, upon approval by USEPA and ASEPA.

~~Measurements should be taken at three depths for each location: 1 meter above the bottom, 1 meter below the surface, and at mid-depth.~~

A study plan which includes standard operating procedures for receiving water quality measurements will be developed and submitted to ASEPA and USEPA for approval within 30 days of the effective date of this revision.

Monitoring stations shall be designated and located as shown (also see Figures 1 and 2-revised):

Offshore Station	Vicinity	Location	Coordinates: ~~Latitude~~ West Longitude		~~Longitude~~ South Latitude	
5	Transition Zone		170° 39' 44.282"	~~.72W~~	14° 17' 53.468"	~~.08S~~
5A	Transition Zone	West	170° 40' 13.000"		14° 18' 29.000"	
6	Outer harbor	Central	170° 40' 11.372"	~~.20W~~	14° 17' 31.322"	~~.52S~~
6A	Outer harbor	West	170° 40' 18.500"		14° 17' 31.000"	
7	Outer harbor	East, S.	170° 39' 56.256"	~~.93W~~	14° 17' 22.339"	~~.37S~~
8	Outer harbor	East	170° 39' 53.960"	~~40'.07W~~	14° 17' 10.830"	~~.17S~~
8a	Middle harbor	East	170° 40' 5.529"	~~.13W~~	14° 16' 51.575"	~~.08S~~
9	Middle harbor	East	170° 40' 9.006"	~~.18W~~	14° 16' 39.561"	~~.66S~~
9a	Middle harbor	East	170° 40' 34.862"	~~.57W~~	14° 16' 34.905"	~~.58S~~
10	Middle harbor	West	170° 40' 39.508"	~~.75W~~	14° 16' 55.258"	~~.87S~~
10A	Middle harbor	West	170° 40' 20.000"		14° 17' 10.000"	
11	Inner harbor	Center, E.	170° 40' 54.092"	~~.90W~~	14° 16' 34.295"	~~.58S~~
11a	Inner harbor	Center, E.	170° 41' 6.540"	~~.13W~~	14° 16' 38.573"	~~.62S~~
12	Inner harbor	Center	170° 41' 20.769"	~~.33W~~	14° 16' 36.564"	~~.60S~~
13	Inner harbor	Center, W.	170° 41' 42.849"	~~.71W~~	14° 16' 30.008"	~~.50S~~
14	Middle harbor	Diffuser	170° 40' 1.678"	~~.03W~~	14° 16' 58.934"	~~.58S~~
15	Middle harbor	ZOM Edge, N.	170° 40' 6.243"	~~.12W~~	14° 16' 45.692"	~~.77S~~
16	Middle harbor	ZOM Edge, W.	170° 40' 13.483"	~~.17W~~	14° 16' 57.273"	~~.56S~~
17	Middle harbor	ZOM Edge, E.	170° 40' 1.158"	~~39'.91W~~	14° 16' 54.398"	~~.90S~~
18	Outer harbor	ZOM Edge, S.	170° 39' 59.177"	~~40'.08W~~	14° 17' 8.862"	~~.10S~~

Note: Revised coordinates listed are locations of stations used and reported in CH2M Hill's July 7, 1995 Report, "Results of March 1995 Harbor Water Quality Monitoring Pago Pago Harbor, American Samoa", and are as read from GPS in field. (A correction factor based on readings at known locations may be required for exact station location.) Latitudes for Stations 14 and 16 originally listed in the permit were incorrect and are corrected here.

It is recommended that the stations be located using the sextant angle resection positioning method or a positioning system which affords an equivalent degree of accuracy and precision. Other means may be used if, in the judgment of ASEPA and EPA Region 9, they are of sufficient accuracy and precision to allow reoccupation of the stations within plus or minus six (6) meters.

The following shall constitute the Water Quality Monitoring Program as shown:

Parameter	Units	Stations	Sample Type		Sample Frequency	
Temperature	°F	all	~~grab~~	continuous(1)	~~monthly~~	semi-annual(2)
pH		"	"	continuous(1)	"	semi-annual(2)
Dissolved Oxygen	mg/l	"	"	continuous(1)	"	semi-annual(2)
~~Suspended Solids~~	~~mg/l~~	~~"~~	~~"~~		~~"~~	
Light Penetration	ft.	"	grab		"	semi-annual(2)
Turbidity	NTU	"	"	continuous(1)	"	semi-annual(2)
Salinity	ppt	"	"	continuous(1)	"	semi-annual(2)
Chlorophyll a (3)	μg/l	"	grab		"	semi-annual(2)
Total Nitrogen (3)	μg/l	"	"		"	semi-annual(2)
Total Phosphorus (3)	μg/l	"	"		"	semi-annual(2)
Total Ammonia (3)	μg/l	"	"		"	semi-annual(2)
Zinc	μg/l	(4)	"			semi-annual(2)
Copper	μg/l	(4)	"			semi-annual(2)

(1) Continuous vertical profiles.

(2) Sampling to occur approximately every 6 months to coincide with the two main oceanographic seasons.

(3) Samples to be taken at the following depths where possible: near surface, 30, 60, 90 and 120 feet, and near bottom. Where water depth is less than 120 feet, a minimum of three samples shall be taken at each station (near surface, mid-depth and near bottom).

(4) The following stations shall be sampled at the noted depths:
Stations 5, 5A, 15, 16 18: 30 feet, 120 feet, near bottom;
Stations 11 and 13: near surface and near bottom.
The number of stations and samples may be adjusted based on the results of the first sampling episode, upon approval by USEPA and ASEPA.

~~Measurements should be taken at three depths for each location: 1 meter above the bottom, 1 meter below the surface, and at mid depth.~~

A study plan which includes standard operating procedures for receiving water quality measurements will be developed and submitted to ASEPA and USEPA for approval within 30 days of the effective date of this revision.

Appendix II

Combined Sampling and Analysis Plan and Standard Operating Procedures

Plan of Study
for
Receiving Water Quality Sampling
Pago Pago Harbor, American Samoa

A Combined
Sampling and Analysis Plan
and
Standard Operating Procedures

Prepared for

StarKist Samoa (NPDES Permit AS0000019)
and
VCS Samoa Packing (NPDES Permit AS0000027)

Submitted to

United States Environmental Protection Agency
and
American Samoa Environmental Protection Agency

Prepared by

CH2M HILL
and
Glatzel and Associates

October 1996 : Revision 2

Purpose

On 8 November 1995 the U.S. Environmental Protection Agency issued a modification to the receiving water quality monitoring requirements of the NPDES permits issued to StarKist Samoa and VCS Samoa Packing. This combined sampling and analysis plan and standard operating procedures (SAP/SOP) has been prepared in compliance with the permits and to maintain a consistent and acceptable quality of data for the monitoring program. This plan has been revised based on experience with the first water quality sampling episode in March 1996. The revisions are minor and consistent with the recommendations that will be presented in report of the March 1996 monitoring.

Scope

The data collection and sampling requirements of the permits are listed in this document, including that supporting or ancillary data not directly referenced in the permit but of value in interpreting results. The SAP/SOP also addresses the sample location and navigation methods to be used and the specific methods to be used to take field measurements and collect, process, store and ship sea water samples. Quality assurance and quality control (QA/QC) and reporting format are also discussed. It is assumed that the field team will be familiar with the types of oceanographic equipment to be used and detailed instructions for the correct use of such equipment is generally not discussed.

Data and Samples Description

The permit requires the in-field measurement of the following variables as continuous vertical profiles: temperature, pH, dissolved oxygen (DO), turbidity, and salinity. In addition a measurement of light penetration is required. The permit also requires the collection of samples for laboratory analysis of chlorophyll-a, total nitrogen, total phosphorous, and total ammonia at all stations. In addition, analyses for zinc and copper are required at selected stations. In support of the primary data collection and sampling the following information will be recorded at each location at the time of sampling and data collection: date, time, personnel present, total water depth, and general meteorological conditions including wind speed and direction, sea state, precipitation condition, and cloud cover.

Sampling Locations and Times

Sampling is to be done twice a year during the two main oceanographic seasons. The two oceanographic seasons are the tradewind and non-tradewind seasons, which are separated by short transition periods. Other studies being conducted under the permit are also aligned with these seasons. Sampling will normally be scheduled for the February-March and August-September-October time periods.

Sampling and data measurement locations consist of twenty (20) stations located throughout Pago Pago harbor and described by latitude and longitude and graphically in the permit and permit modification. At each station location continuous vertical profiles will be taken, other data as described above will be recorded, and samples will be collected at the following depths: near surface, 30 feet, 60 feet, 90 feet, 120 feet, and near bottom. Where water depth is less than 120 feet samples will be collected at three depths including: near surface mid-depth, and near bottom. The sample collection for metals is abbreviated and samples will be collected at three depths (30 feet, 120 feet, and near bottom) at five (5) stations and at surface and near bottom at two stations. The stations for metals sampling are specified in the permit modification.

Station locations are specified in the permit both by latitude and longitude and graphically. Problems have been encountered previously in correlating the latitude-longitude coordinates with known or charted positions in Pago Pago Harbor. There are at least three datums in use in various references: Preliminary NAD (North American Datum) 1927, NAD 1927, and NAD 1983 which essentially corresponds to WGS (World Geodetic System) 1984 as typically used in satellite navigation systems and global positioning systems (GPS). Therefore, latitudes and longitudes derived from different sources can be significantly different for the same point or feature on the ground. The procedure described below will be used to avoid confusion in the future.

GPS positioning will be used for station locations. During the first data collection episode We will recorded, and permanently store, the WGS coordinates of the stations actually occupied for this sampling and will use the same coordinates for all future sampling episodes. Since differential GPS is not yet available in American Samoa one of two methods will be used for station location: installation of a base unit at a known bench mark or, during each sampling two known bench marks will be visited and the appropriate corrections will be recorded and applied to determine the station location. These methods should provide sufficient accuracy for water quality sampling (the occupation at two benchmarks will also provide an estimate of precision).

Sample Collection

Water samples will be collected from each depth specified in the permit using a Niskin type sampling bottle. Following the determination of total water depth as described below, the collection bottle will be lowered to the appropriate depth using a measured line and allowed to hang for a minimum of 1 minute. The bottle will then be triggered by a messenger dropped down the line and the bottle retrieved. Sample bottles, as described in Table 1, will be immediately filled and preserved as indicated in the table, stored on ice, and prepared for shipment to the laboratory. In addition, a minimum of two liters will be collected and stored on ice for chlorophyll-a filtering and analysis. The chlorophyll samples will be filtered through a Whatman grade GF/F glass microfiber filter paper (0.7 micron) using a vacuum pump apparatus within twenty-four hours of sample collection. The filters will be treated with manganese sulfate as a preservative and then stored in a freezer until being sent to the laboratory for analysis.

Parameter Measurements

As described above, in addition to the required continuous vertical profiles, the following information will be recorded at each location at the time of sampling and at the time of profile collection (if different): date, time, personnel present, total water depth, and general meteorological conditions including wind speed and direction, sea state, precipitation condition, and cloud cover. The continuous profiles may be taken at the same time or at different times from the sample collection. If the profiling is done at a different time, the same information listed above will be recorded. Also a measure of light penetration, as described by Secchi depth will be collected at each station either during the time of sample collection or vertical profiling. The various parameters will be measured as follows:

- Water depth will be measured using a non-recording portable fathometer or a measured and marked lead line
- Secchi depth will be determined by using a standard size and patterned Secchi disk lowered through the water column on a measured line
- Wind speed and direction will be estimated using a small hand held anemometer and compass
- Other meteorological parameters will be estimated visually

Conductivity, temperature, depth (pressure), DO, pH, and turbidity will be measured using an internally recording profiling instrument (CTD) which has been calibrated by the manufacturer prior to shipment to American Samoa. Salinity and sea water density will be calculated from conductivity and temperature using the manufactures supplied software or other appropriate formulations. Backup instruments for all parameters will be available in case of failure of any or all of the profiling sensors. In such a case measurements will be taken using the individual grab samples.

The profiling instrument to be used should be tested dockside in a side-by-side test with calibrated meters for each parameter. This should be done prior to any sample collection. If any parameters recorded by the profiling instrument are not being measured and recorded in a satisfactory manner, alternative measurements should be taken. These alternative measurements should be done as follows:

- Temperature and DO must be measured in each individual grab sample at the time of sample collection
- Conductivity (salinity and density) and pH may be measured at the time of sample collection, or measured in subsamples from the samples to be filtered for chlorophyll-a analysis
- Turbidity will be measured in the laboratory at the time of nutrient analysis; this requires no extra sample collection and simply needs to be indicated on the chain of custody forms

Sample Handling

The general procedure for handling samples is outlined below. Note that special procedures for the chlorophyll-a samples are discussed above. In the field, sample collection should use the following procedure:

- Label the individual grab sample containers as listed in Table 1 with an appropriate and unique sample identifier and date and time, bottles should be pre-labeled prior to sample collection in the field

- Fill the bottles to the top, and cover the container securely with its lid.

- Store all samples in coolers on ice at a temperature of approximately 4 °C until packaging for shipment to the laboratory.

One chain-of-custody form is required for each cooler of samples that will be shipped. Sample identification on the chain-of-custody should match the labels on the sample containers exactly. Any multiple samples or backup samples must be appropriately indicated on the chain of custody form. The methods requested should be shown on the chain of custody form. Also, note on the chain-of-custody form that samples are sea water.

Prior to shipping, acid preserved samples should be checked for pH and the pH should be adjusted as necessary to meet the requirements listed in Table 1. Each glass sample bottle should be wrapped in bubble-wrap or an equivalent packaging material and placed in a plastic zip-lock bag. Plastic sample bottles should be placed in a plastic zip-lock bags as well. As much air as possible should be removed from the bag prior to sealing it. Too much air inside the bags will expand during the flight and pop the bag open. Place sample bottles inside the cooler. Packaging material (bubble wrap or equivalent) should be placed in the cooler to prevent bottles from moving and impacting each other.

Ice or an equivalent means (such as chemical cold packs) must be included to keep the samples cold during shipping. <u>Do not use dry ice to pack the samples</u>. If ice is used, precautions should be taken to prevent melted ice from leaking out of the cooler during shipping. These include taping any drain plugs in the cooler shut with duct tape or strapping tape, and "double-bagging" the ice cubes in zip-lock bags. As with the bags used to hold the sample bottles, as much air as possible should be removed from the bags prior to sealing.

The chain-of-custody form for each cooler should be signed, placed in a zip-lock bag, and taped with duct tape to the inside of the cooler lid. The cooler should be taped securely shut with strapping tape or other strong packaging tape to prevent it from opening during shipping.

Quality Assurance And Quality Control

The quality assurance and quality control objectives for the study are to collect physical and hydrographic data and representative samples at predetermined locations and provide field and laboratory measurements that are of known and acceptable quality. A list of field equipment is given in Table 2. The following requirements will be followed to meet the objectives:

- Maintain and document accurate positioning for sample collection
- Verify the GPS at known points near or within the study area
- Provide field equipment redundancy (backup equipment)
- Develop and use the field standard operations procedures (SOP) as described in this document
- Obtain all equipment prior to the beginning of the field collections and check to verify correct operation
- Any instrument requiring calibration will be checked and calibrated upon its arrival to confirm that it is in working condition.
- Examine samples as collected and subsequent data analysis by experienced scientists
- Provide verifiable laboratory chemical analyses with appropriate QA to evaluate accuracy and precision targets

Health and Safety Considerations

The data and sample collection and preparation should be done or directly supervised by staff that are experienced with this type of work and are fully aware of all health and safety practices that apply in such cases.

Reporting

A report of the results will be provided to USEPA and ASEPA after receipt and post processing of the results of the chemical sample analyses. Field data will be summarized and positioning data will be tabulated. Laboratory chemical data will be reviewed to determine whether analytical accuracy and precision targets were achieved and to assess the laboratory quality assurance. Chemical analyses results will be presented in tabular formats. Any proposed revisions to the study plan will be presented in the report. Review comments from USEPA and ASEPA will be incorporated into the revised study plan as appropriate.

- An introduction presenting the background, rationale, objectives and setting of the study
- A section describing the approach and methods, including any deviations or changes from the study plan, and justification for any such deviations

- A section presenting summary results of the information gathered
- A section discussing any pertinent conclusions, recommendations, and proposed changes to the study
- Appendices containing the study plan, a record of approvals of any previous changes to the study, the laboratory reports, chain-of-custody records, and any other pertinent information

Table 1
Pago Pago Harbor Water Quality Monitoring
Sample Analysis And Handling Procedures

ANALYTE	METHOD	REPORTING DETECTION LIMIT	SAMPLE HOLDING TIME	SAMPLE CONTAINER	SAMPLE PRESERVATION
Temperature	Field Probe	0.1°C	N/A	N/A	none
Salinity	Field Probe	0.1 PSU	N/A	N/A	none
Dissolved O_2	Field Probe	0.1 mg/l	N/A	N/A	none
pH	Field Probe	0.1 SU	N/A	N/A	none
Turbidity	Field Probe	0.2 NTU	N/A	N/A	none
Turbidity[1]	EPA 180.1	0.01 NTU	48 hours [2]	500 ml plastic	none
Nitrite Nitrogen	EPA 354.1	0.001 mg/l	48 hours [2]	2 - 500 ml plastic	4°C - H_2SO_4
Nitrate + Nitrite	EPA 353.2	0.010 mg/l	28 days		
Ammonia Nitrogen	EPA 350.1	0.005 mg/l	28 days		
Total Kheldal Nitrogen	EPA 351.3	0.025 mg/l	28 days		
Total Phosphorus	EPA 365.2	0.005 mg/l	28 days		
Chlorophyll-a	SM 1002 G	0.03 mg/m ^{3}	3 months	Whatman grade GF/F glass microfiber filter (0.7 micron)	frozen, manganese sulfate
Zinc	EPA 200.7	20 μg/l	6 months	500 ml plastic	4°C - HNO_3 to a pH of ≤ 2
Copper	EPA 200.7[3]	2 μg/l			

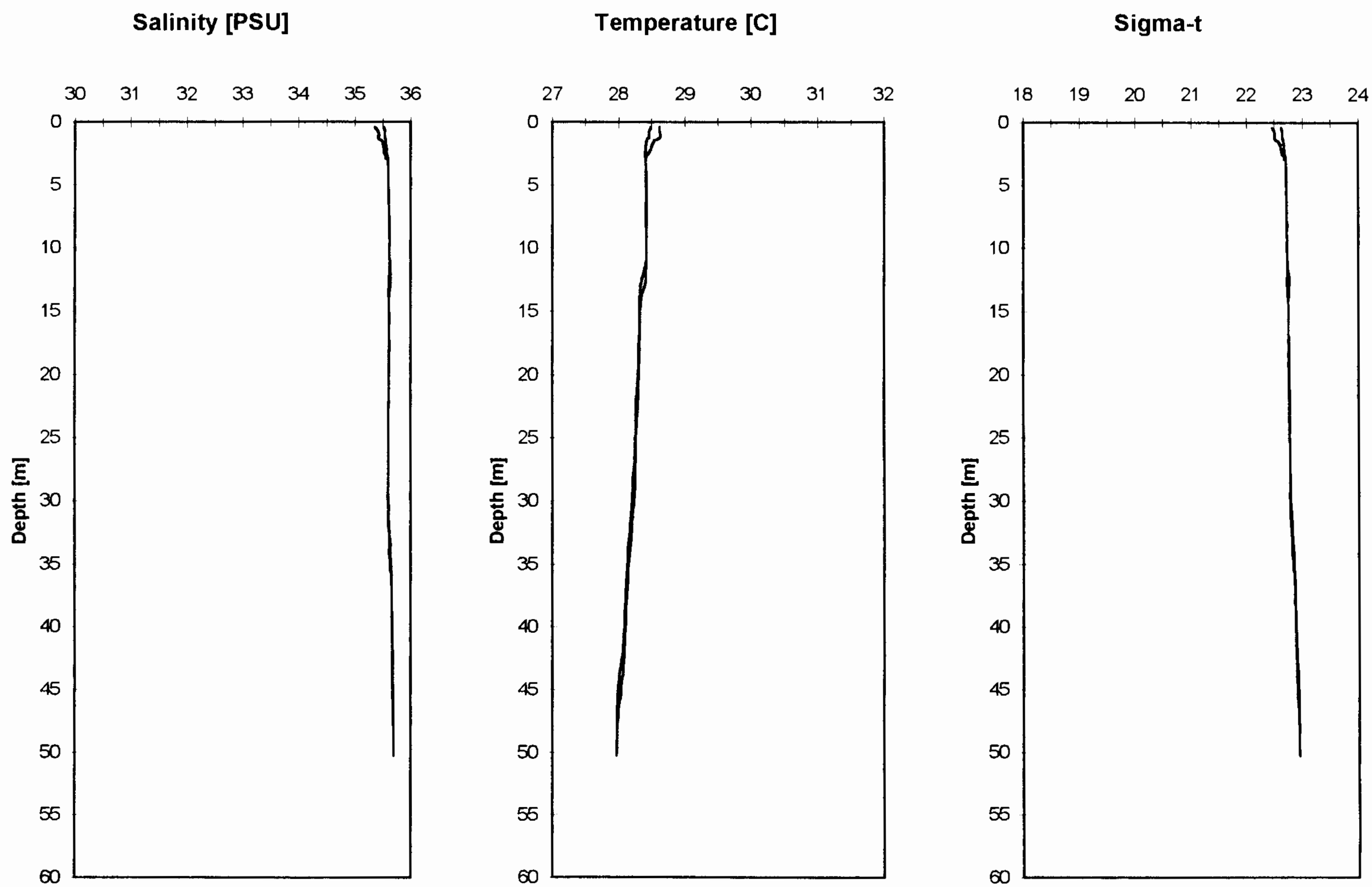
Notes:
[1] Turbidity samples sent to lab from selected stations only to verify probe readings. Stations selected at discretion of filed team leader.
[2] Holding times for turbidity and nitrite nitrogen are unavoidably exceeded because of logistics involved in shipping from American Samoa. The laboratory (AMTEST) agreed to test for these constituents immediately upon receipt of the samples.
[3] To be analyzed following extraction by coprecipitation to achieve the requested detection limit

Table 2 **Field Equipment for Field Data Measurement and Sample Collection**			
Equipment Item	**Purpose**	**Number of Units**	**Accuracy Standard**
Work Vessel	Serves as field sampling platform	1	N/A
GPS (or equivalent)	Station positioning system using GPS	1	± 10 meters
Tape measure and/or marked line	Establish depths at sampling locations (backup for fathometer)	1	± 1 foot
Niskin Sampling Bottles (or equivalent)	Collect water samples	2	N/A
Conductivity, Salinity, Temperature (SCT) Meter	Backup for profiling instrument	1	Temp: ± 0.2 °C Cond: ± 0.5 mS/cm Salinity: ± 0.2 PSU
pH Meter	Backup for profiling instrument		pH: ± 0.2 SU
Dissolved Oxygen . meter	Backup for profiling instrument	1	DO: ± 0.2 mg/l
Profiling CTD with DO, pH, and Turbidity sensors	Record temperature, conductivity, depth	1	Temp: ± 0.1 °C Cond: ± 0.1 mS/cm Depth: ± 0.1 meter pH: ± 0.2 SU DO: ± 0.2 mg/l Turbidity: ± 0.1 NTU
Vacuum Filtering Apparatus and Filter Paper	Prepare chlorophyll samples	1	N/A
Fathometer	Measure depth at each station	1	± 1 foot
Sample Containers and Preservatives	Collection of receiving water samples for chemical analyses, including sample to be filtered for chlorophyll-a analysis	As required	Pre-cleaned sample containers
Ice Chests	Hold sample jar, cool samples on ice, and ship samples	As required	Pre-cleaned containers

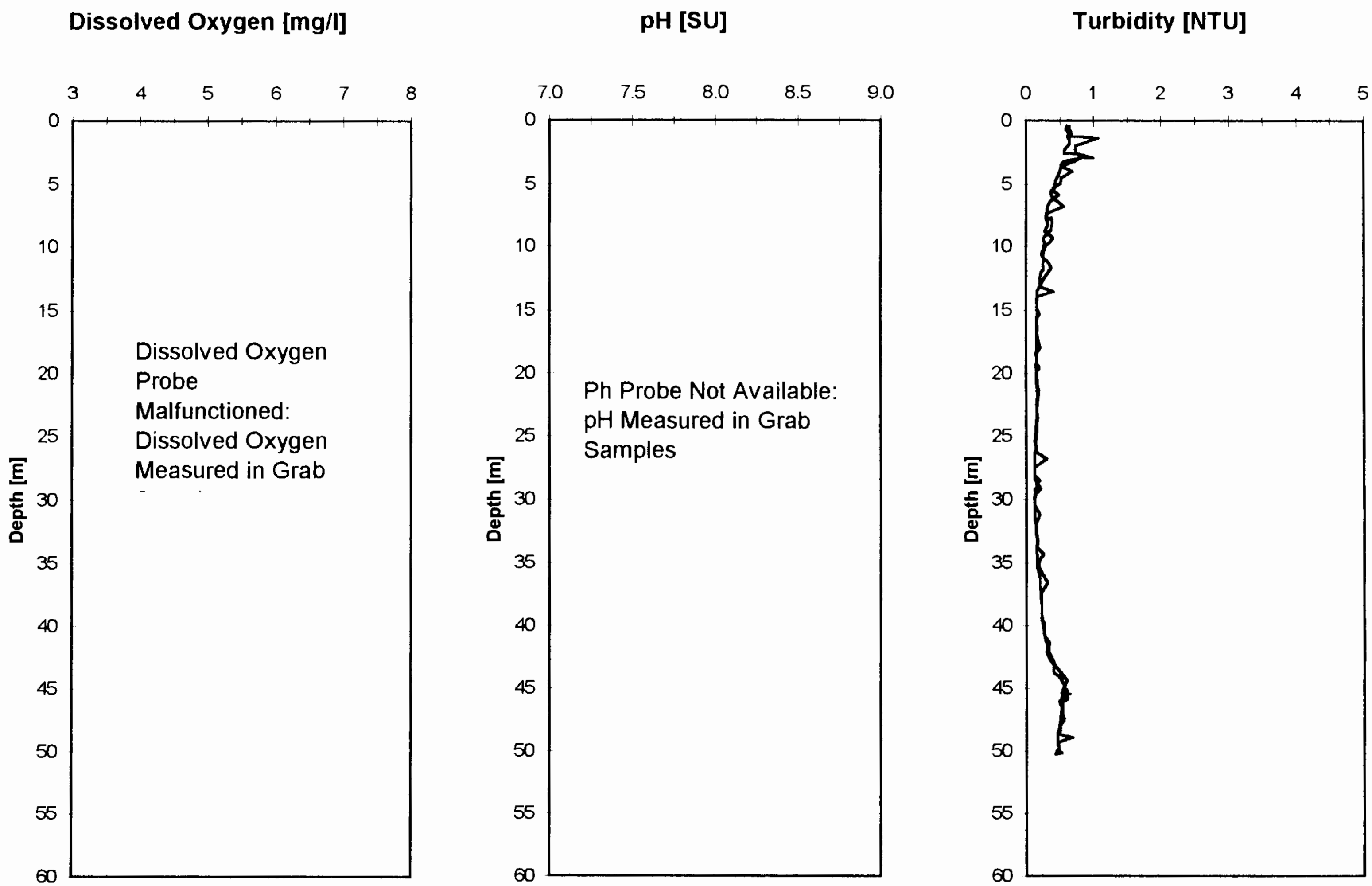
Notes: N/A = Not applicable

Appendix III

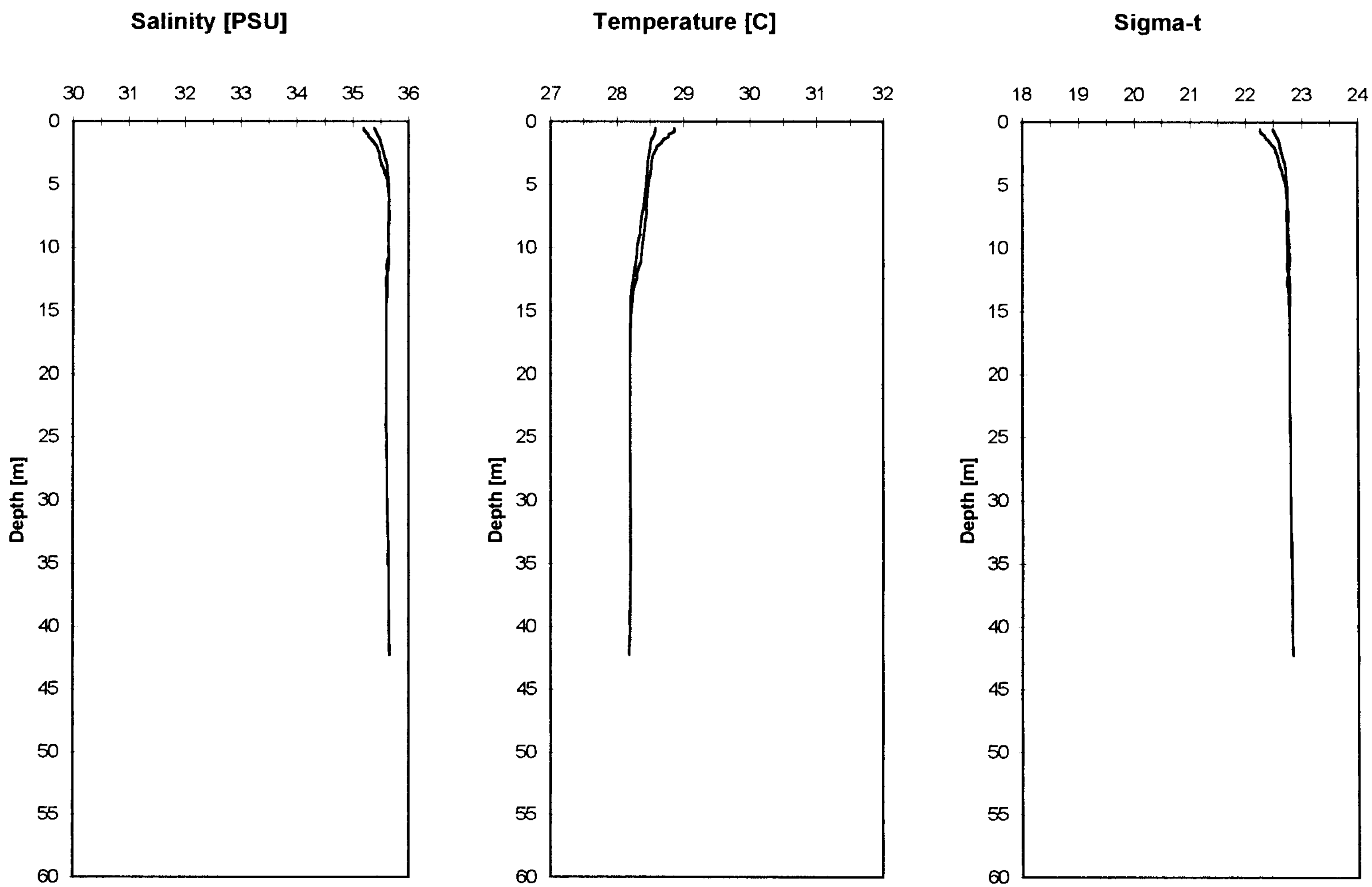
Vertical Profile Data for Each Station



Station 5
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



Station 5
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996

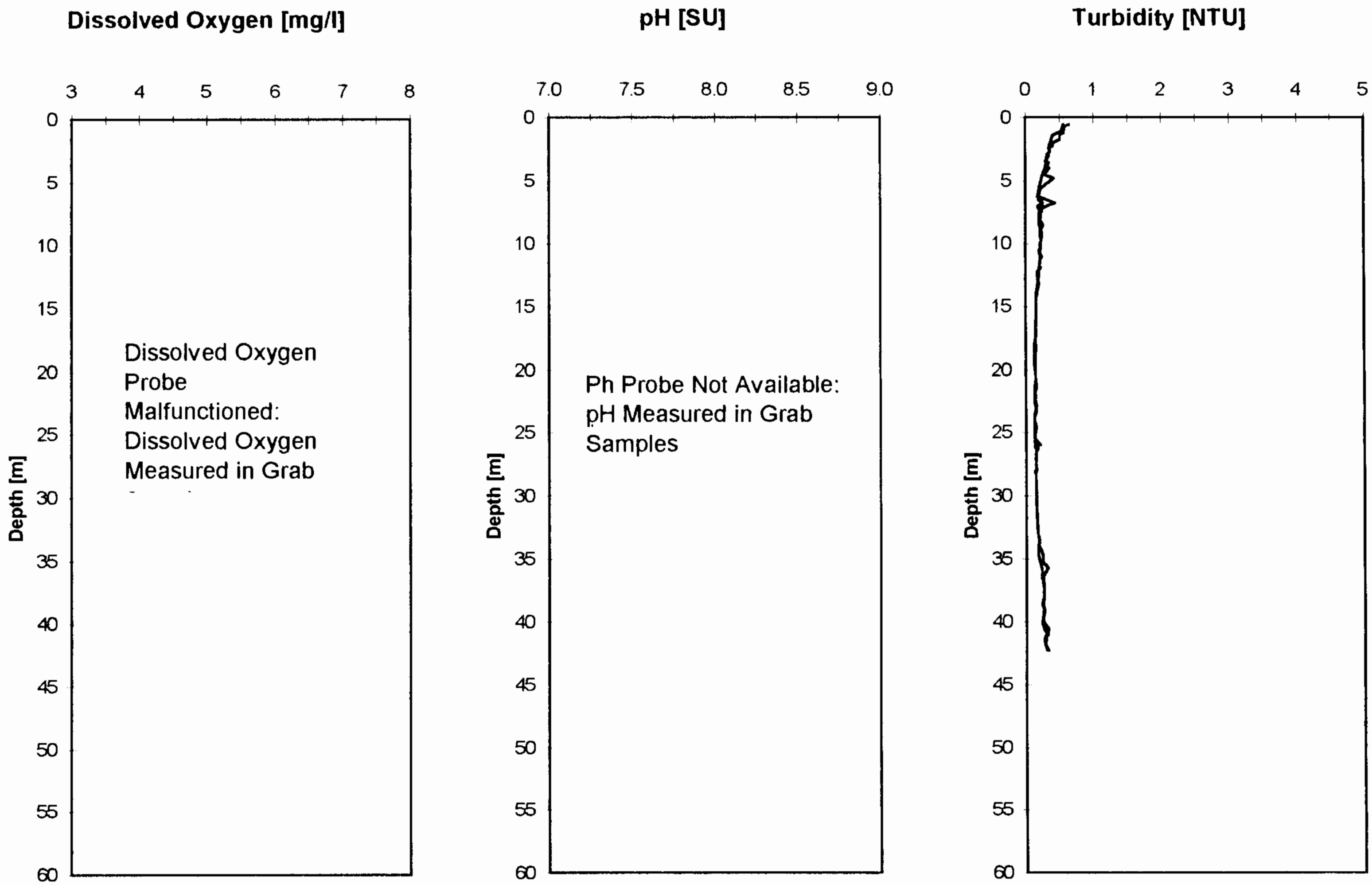


Station 5A

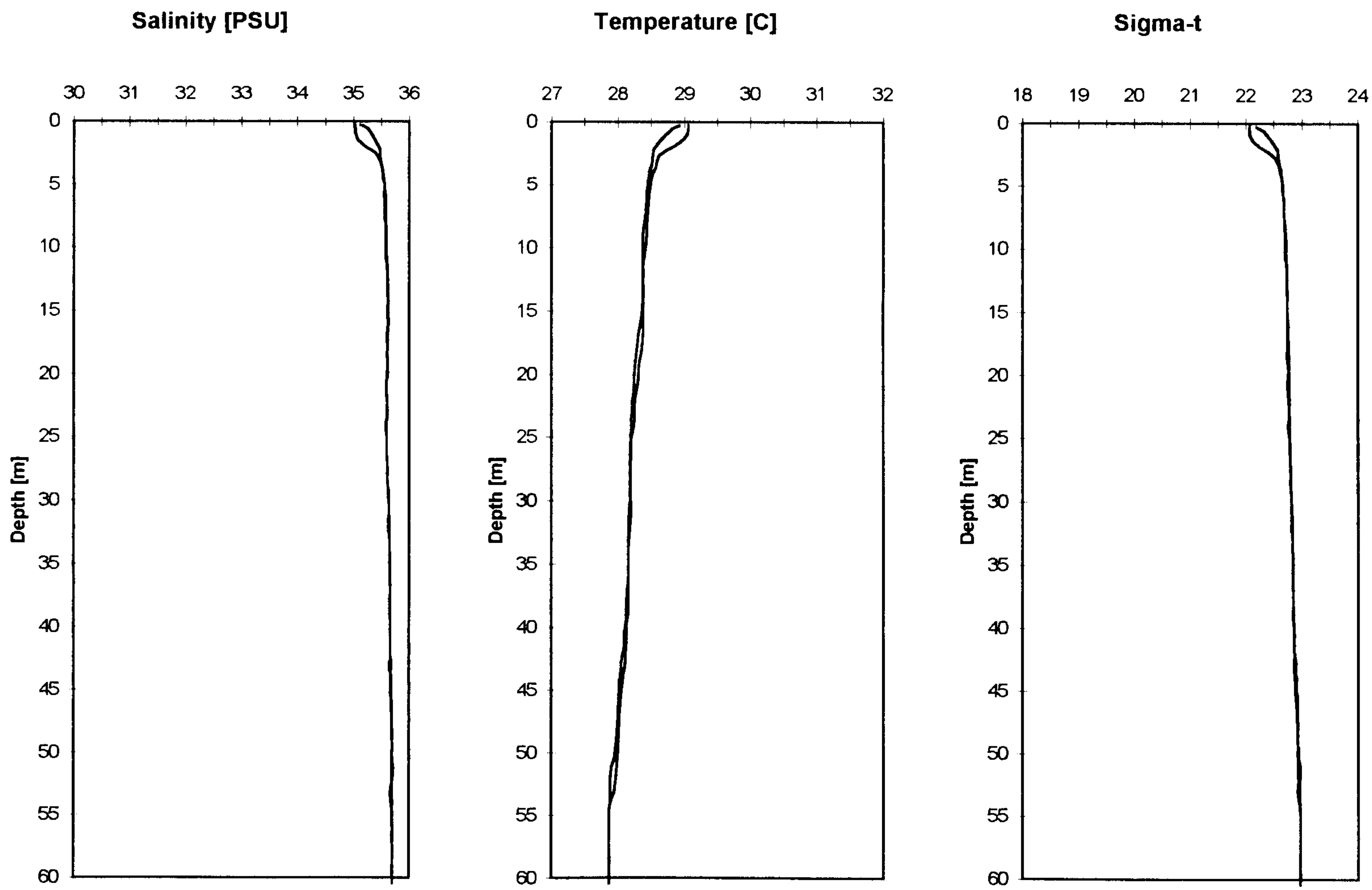
Pago Pago Harbor Water Quality Monitoring Profiles

Salinity, Temperature, and Density

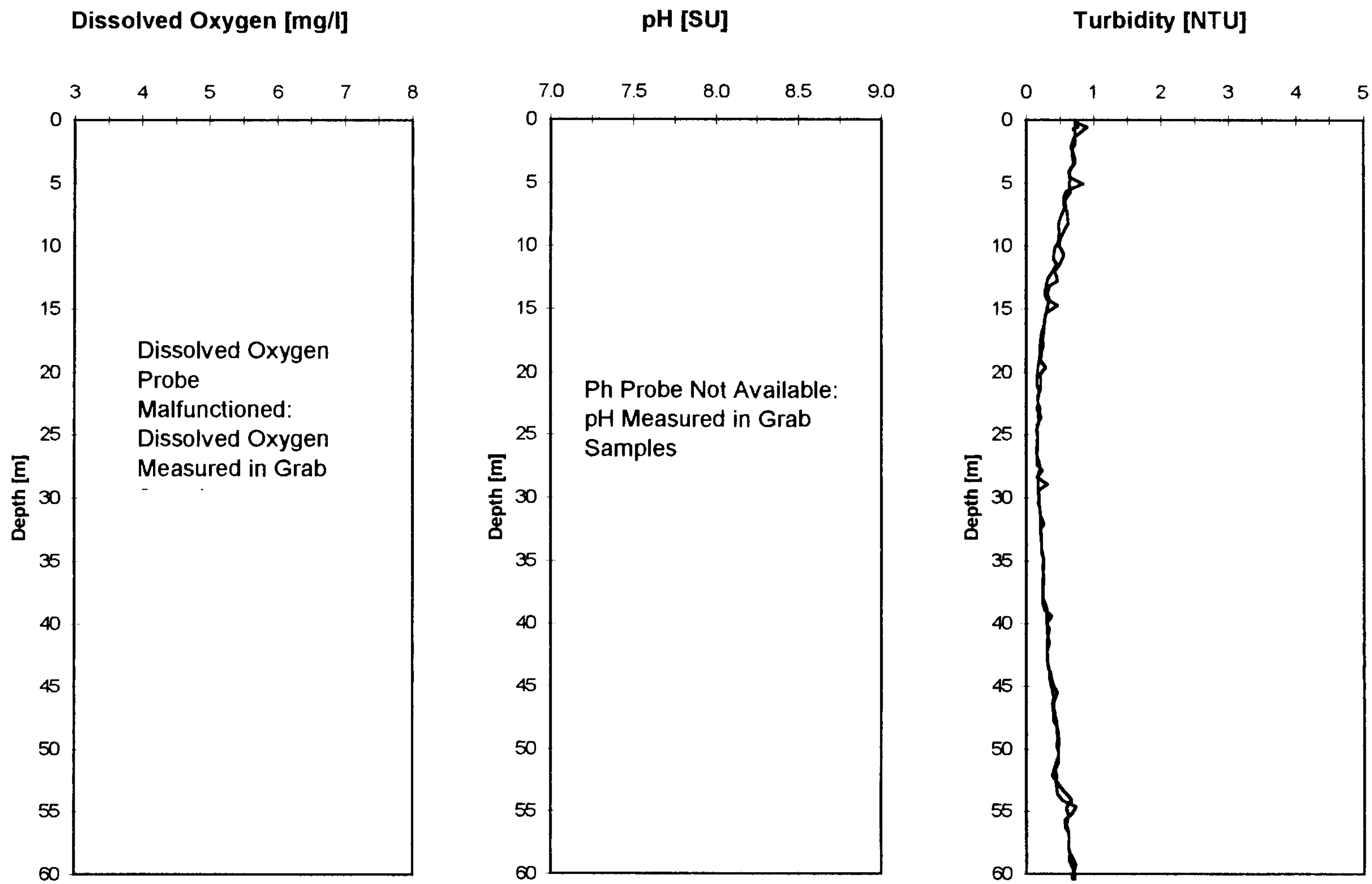
23 November 1996



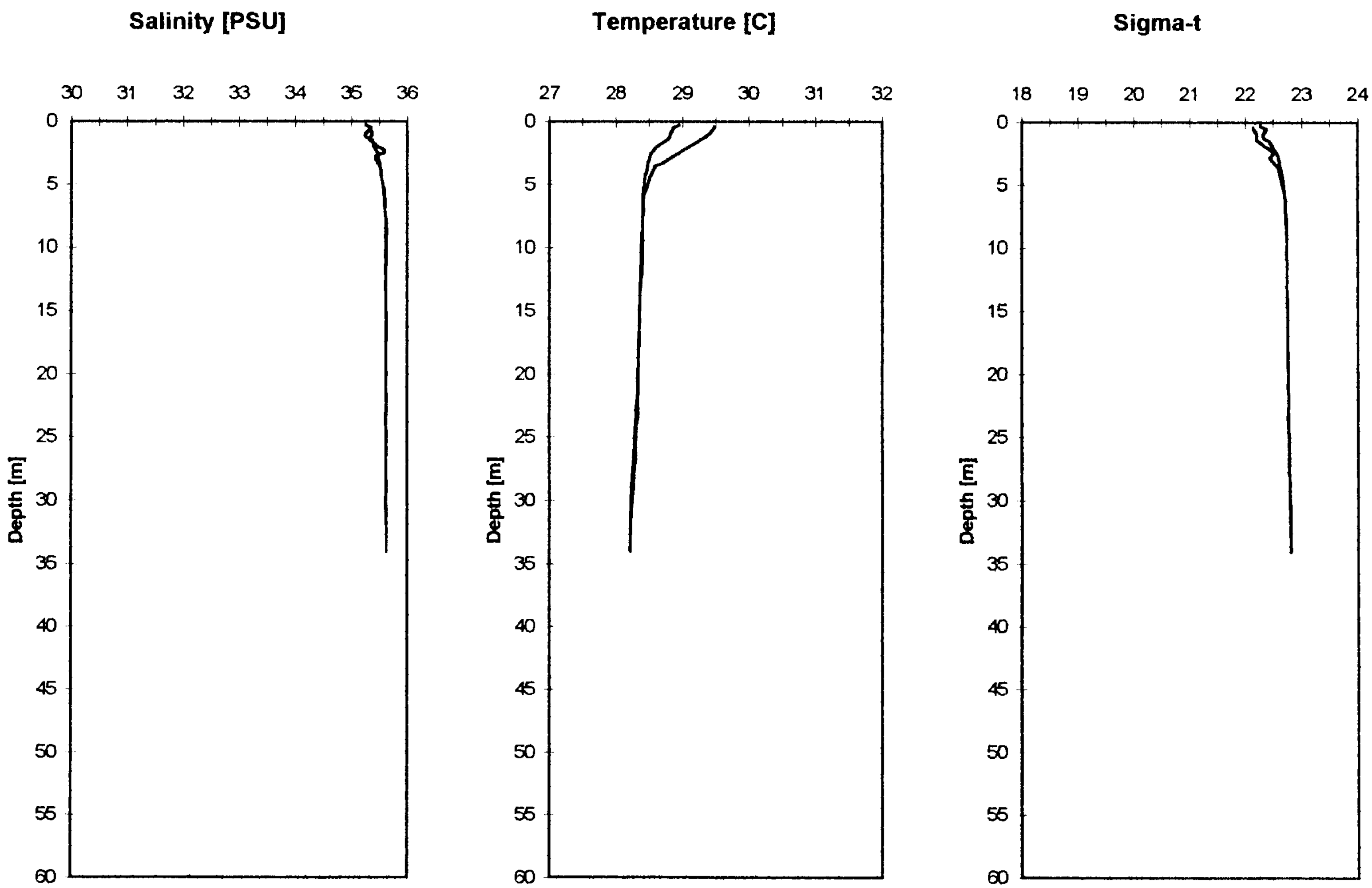
Station 5A
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



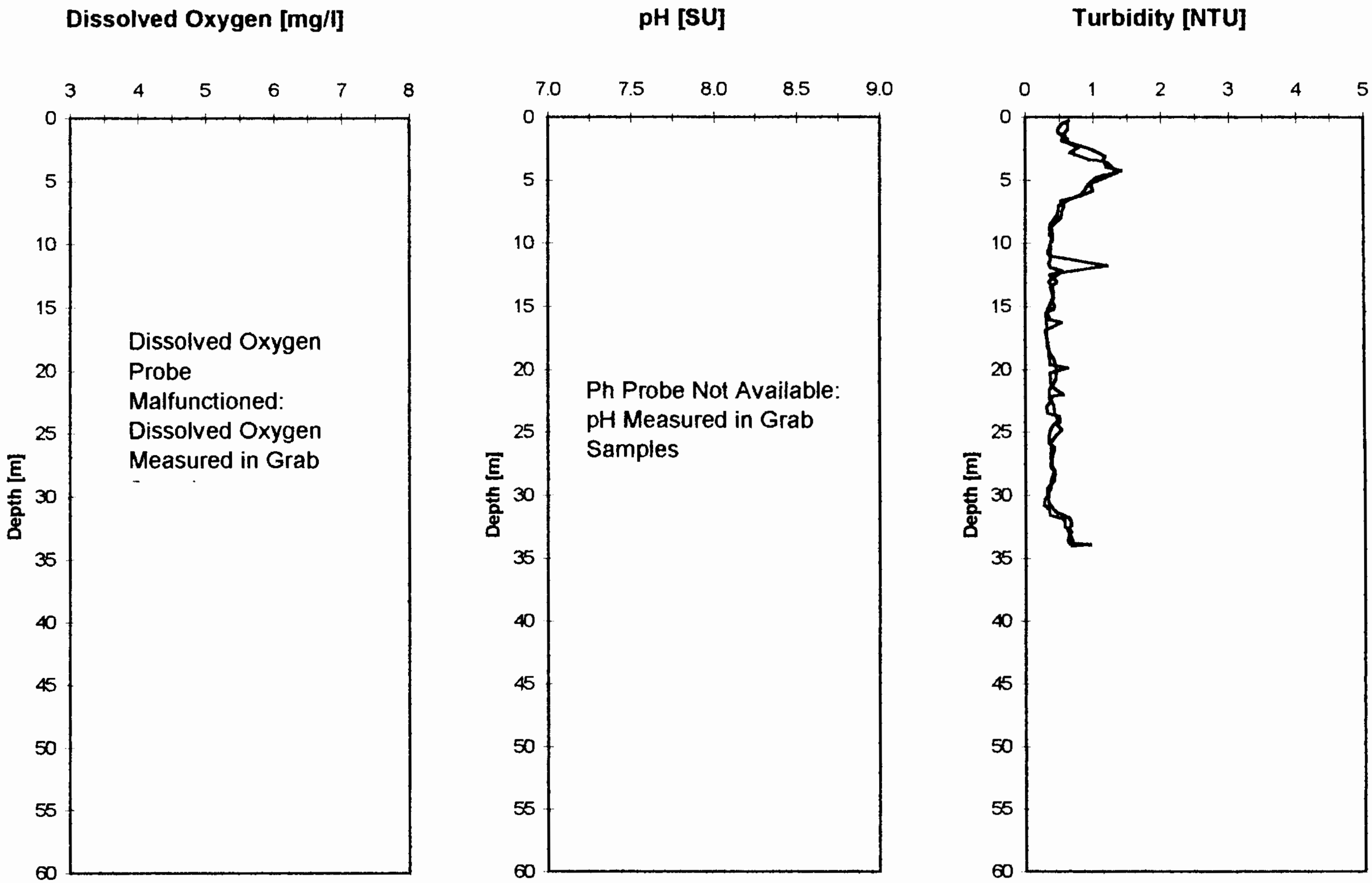
Station 6
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



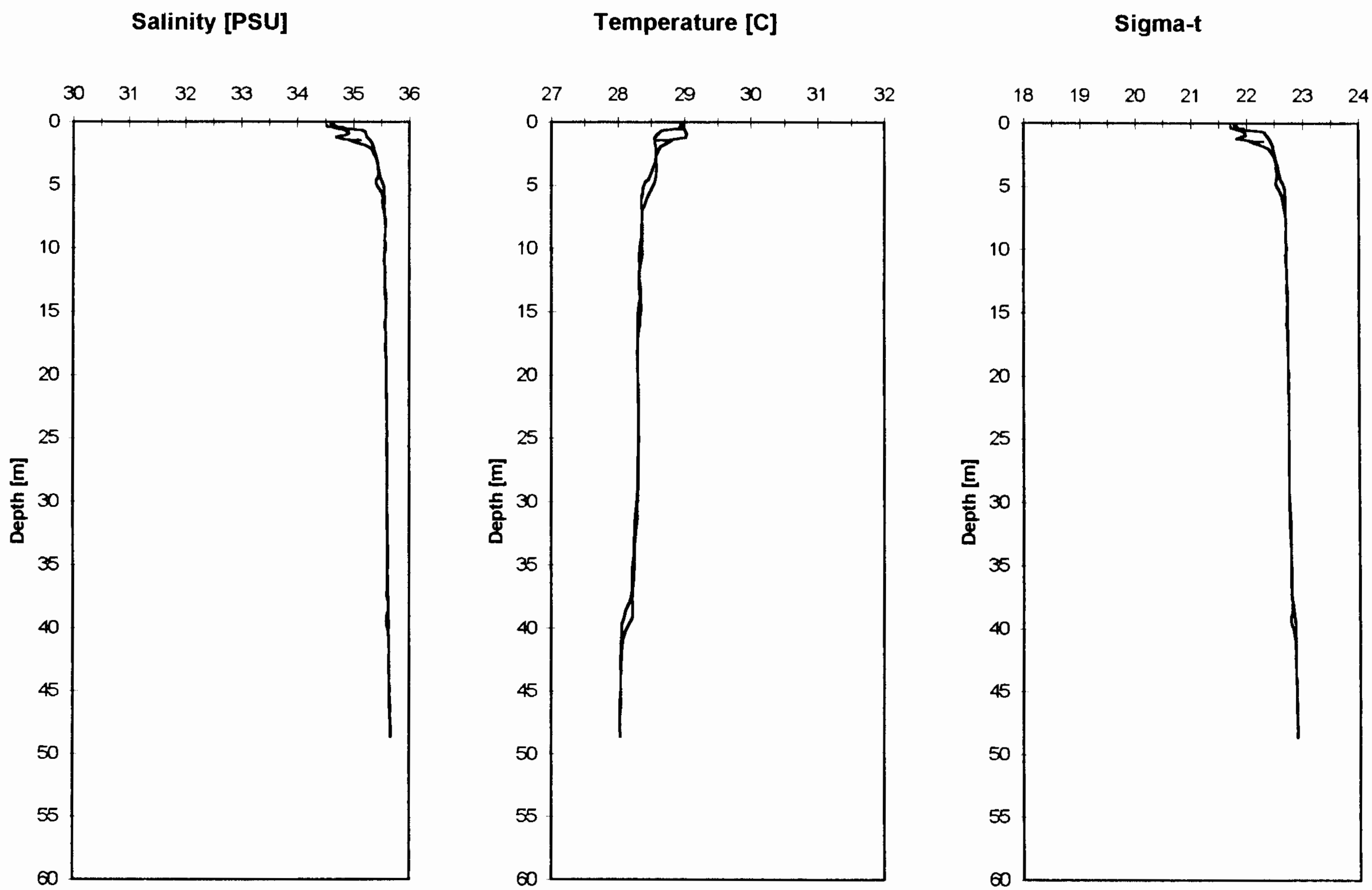
Station 6
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



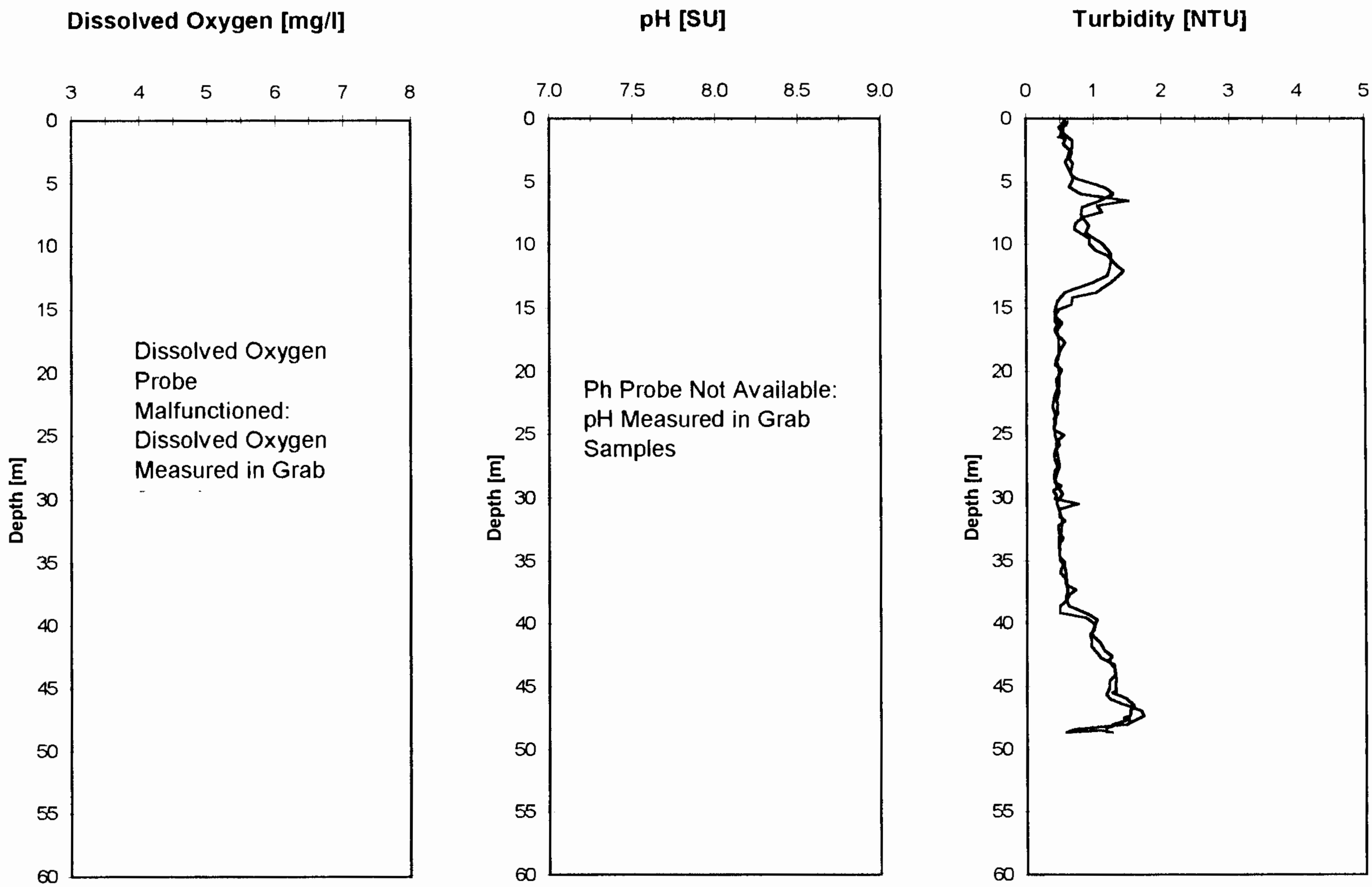
Station 6A
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



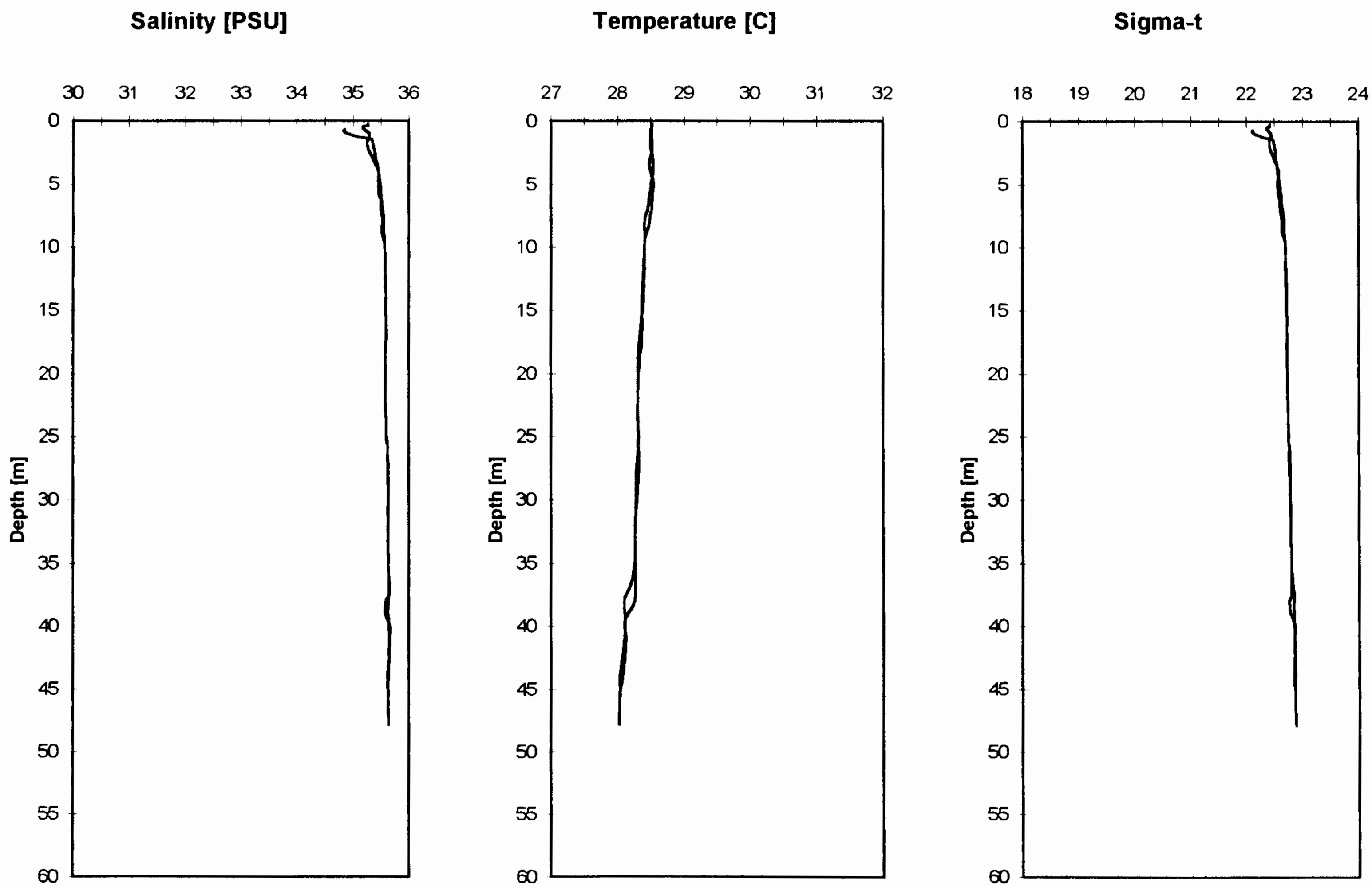
Station 6A
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



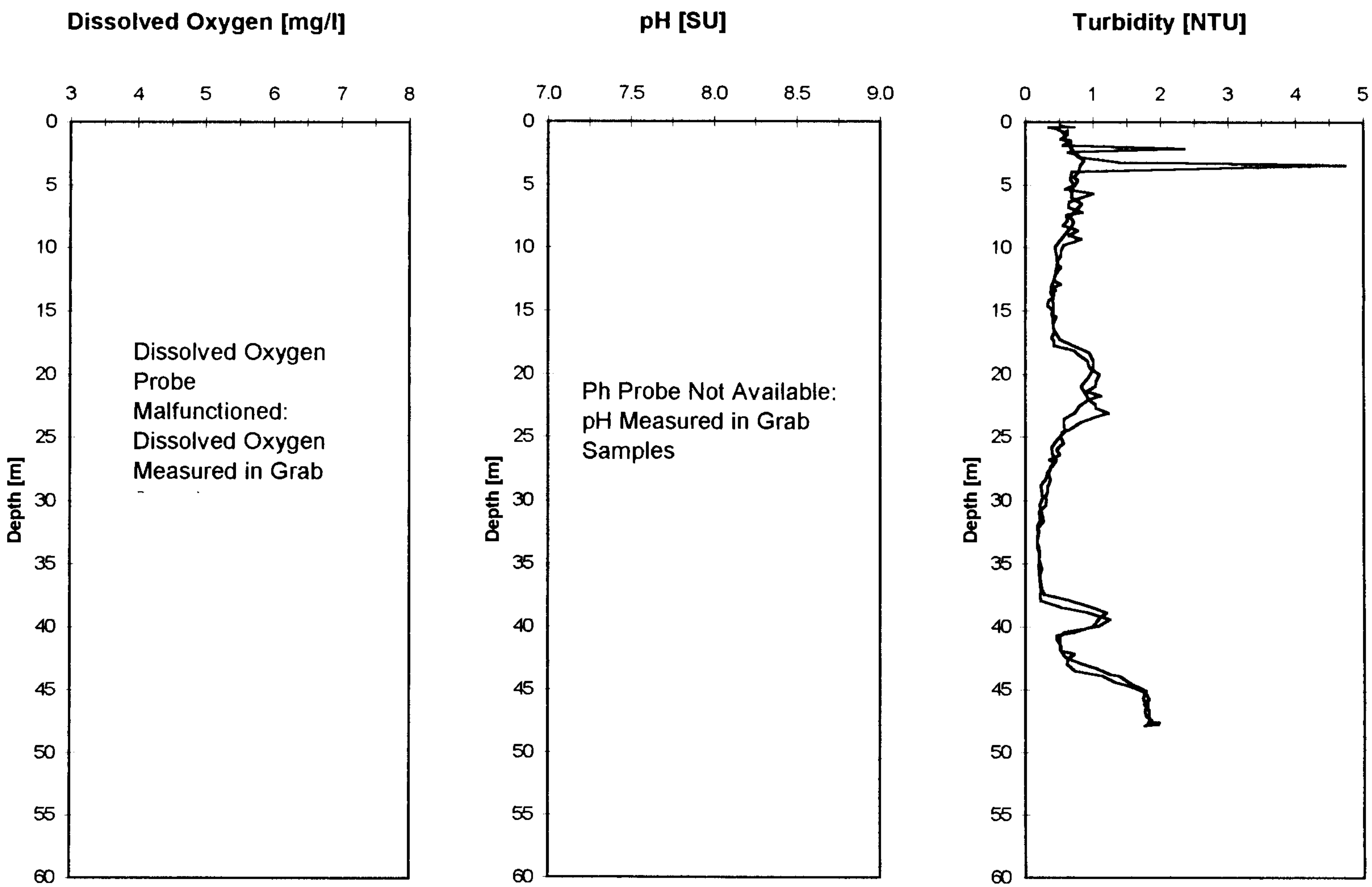
Station 7
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



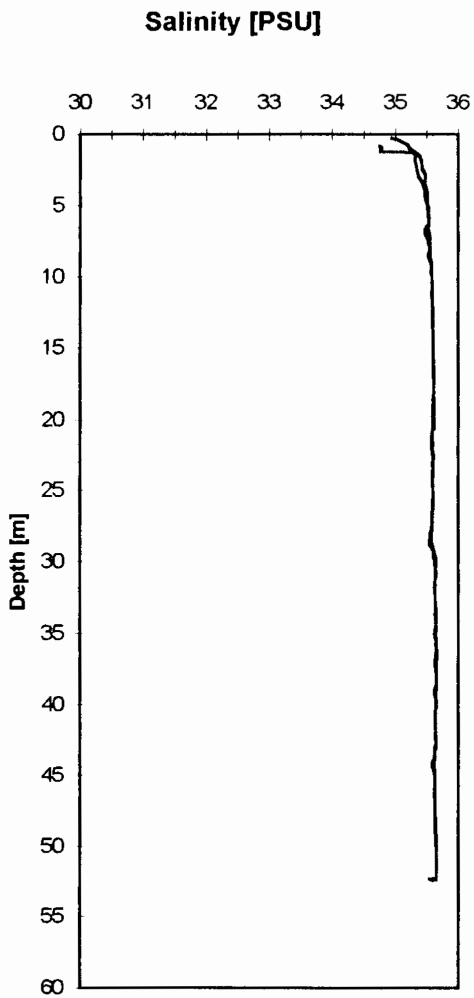
Station 7
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996

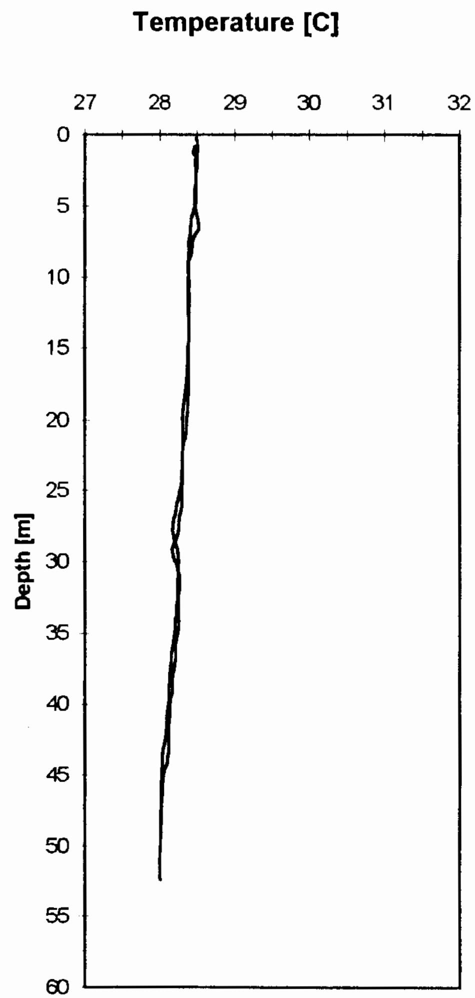


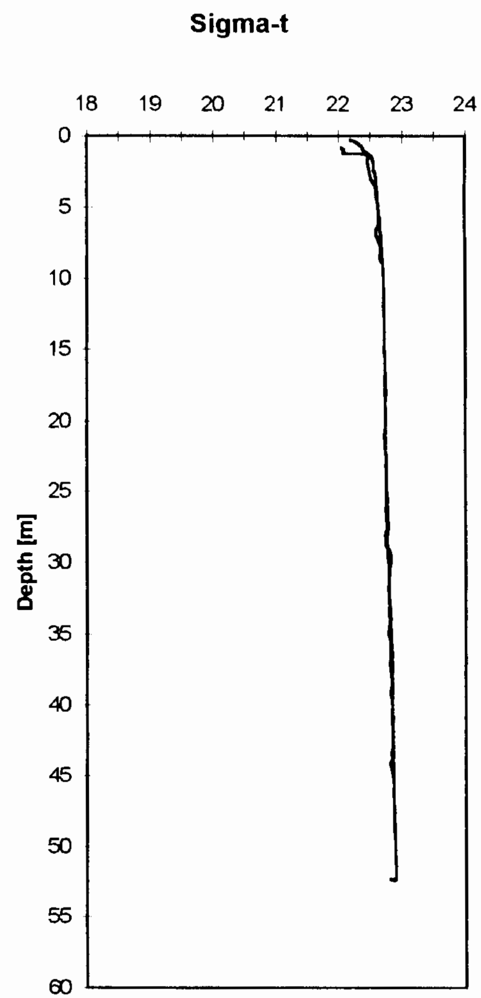
Station 8
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



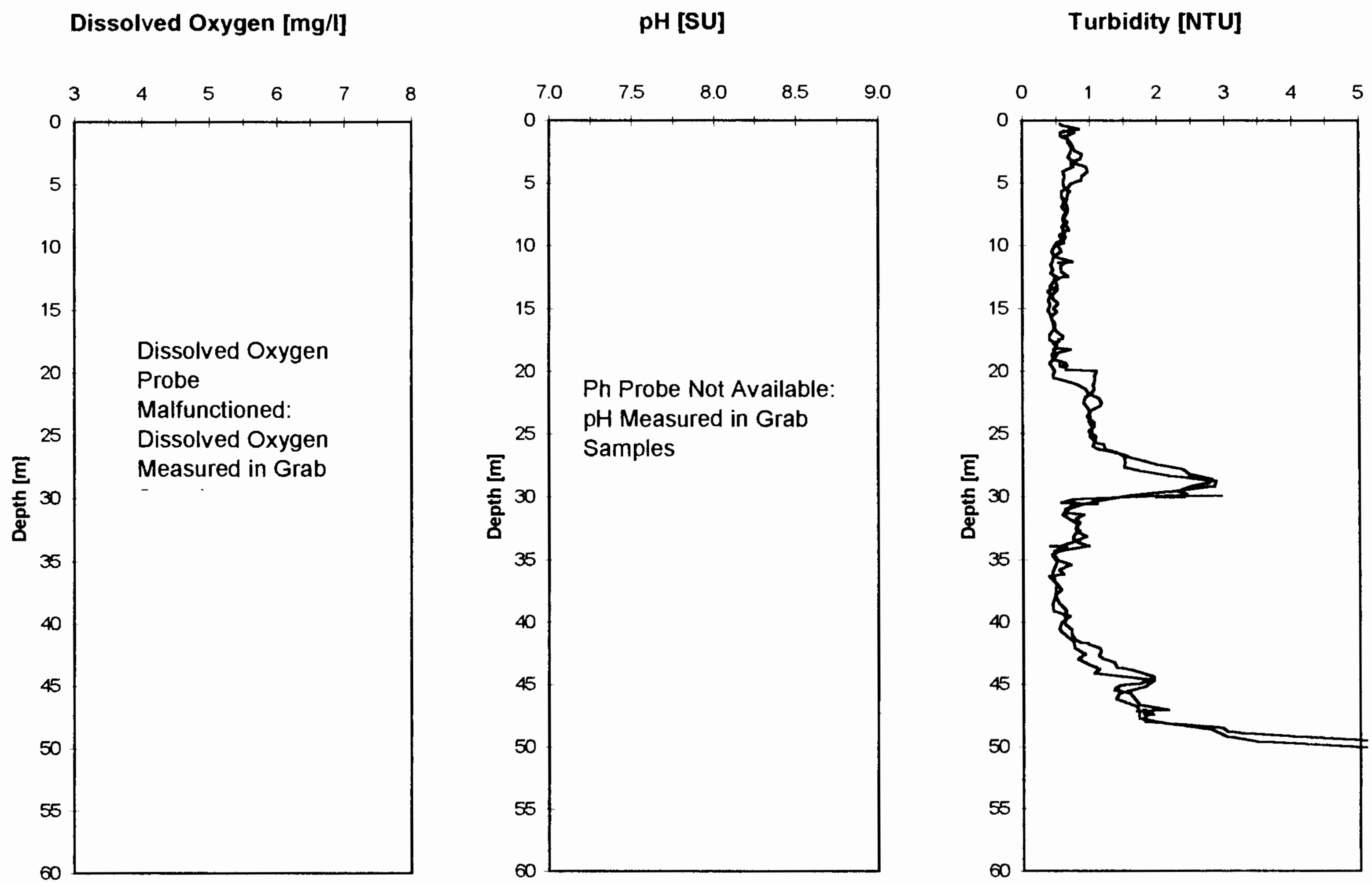
Station 8
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



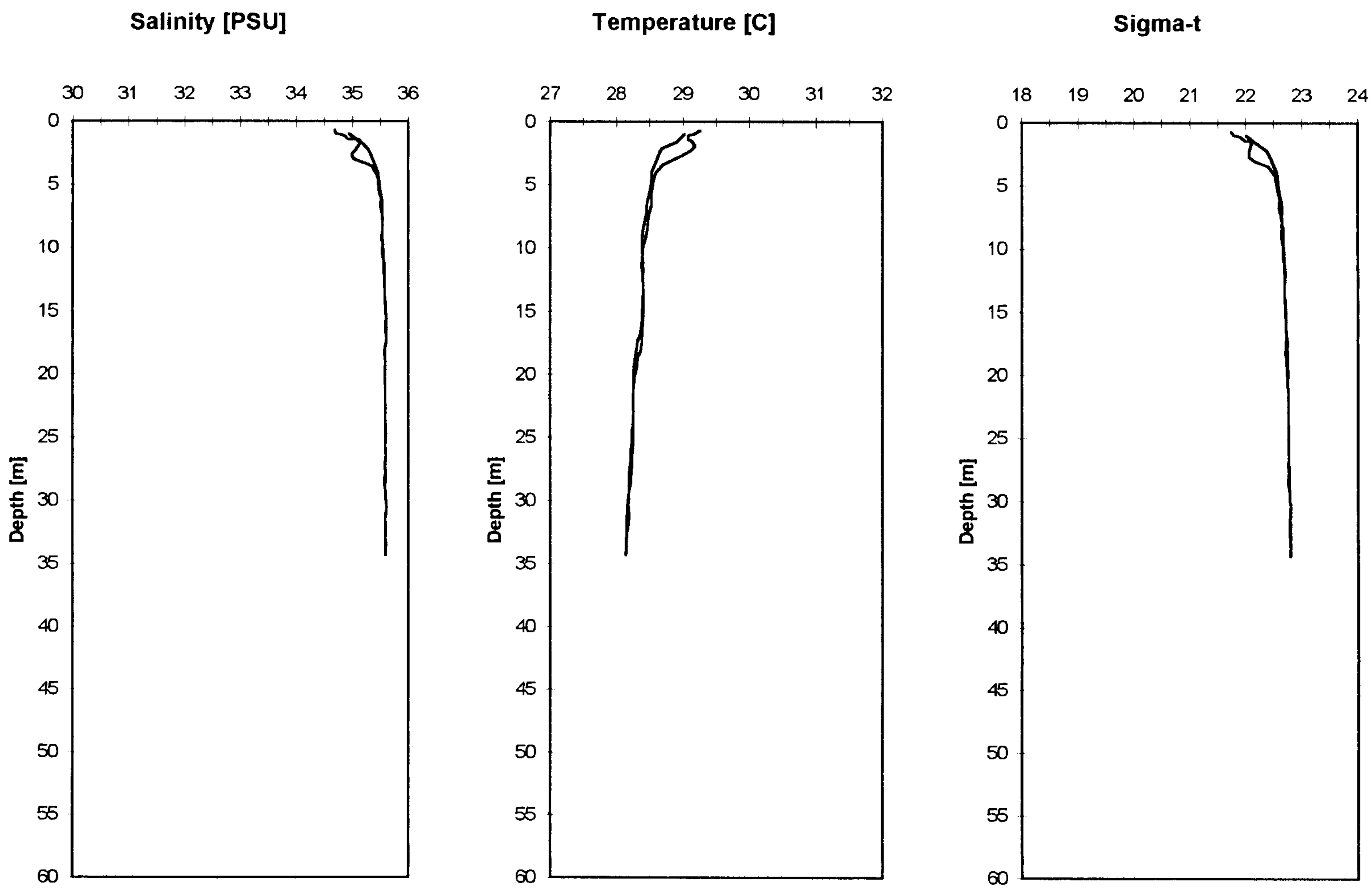




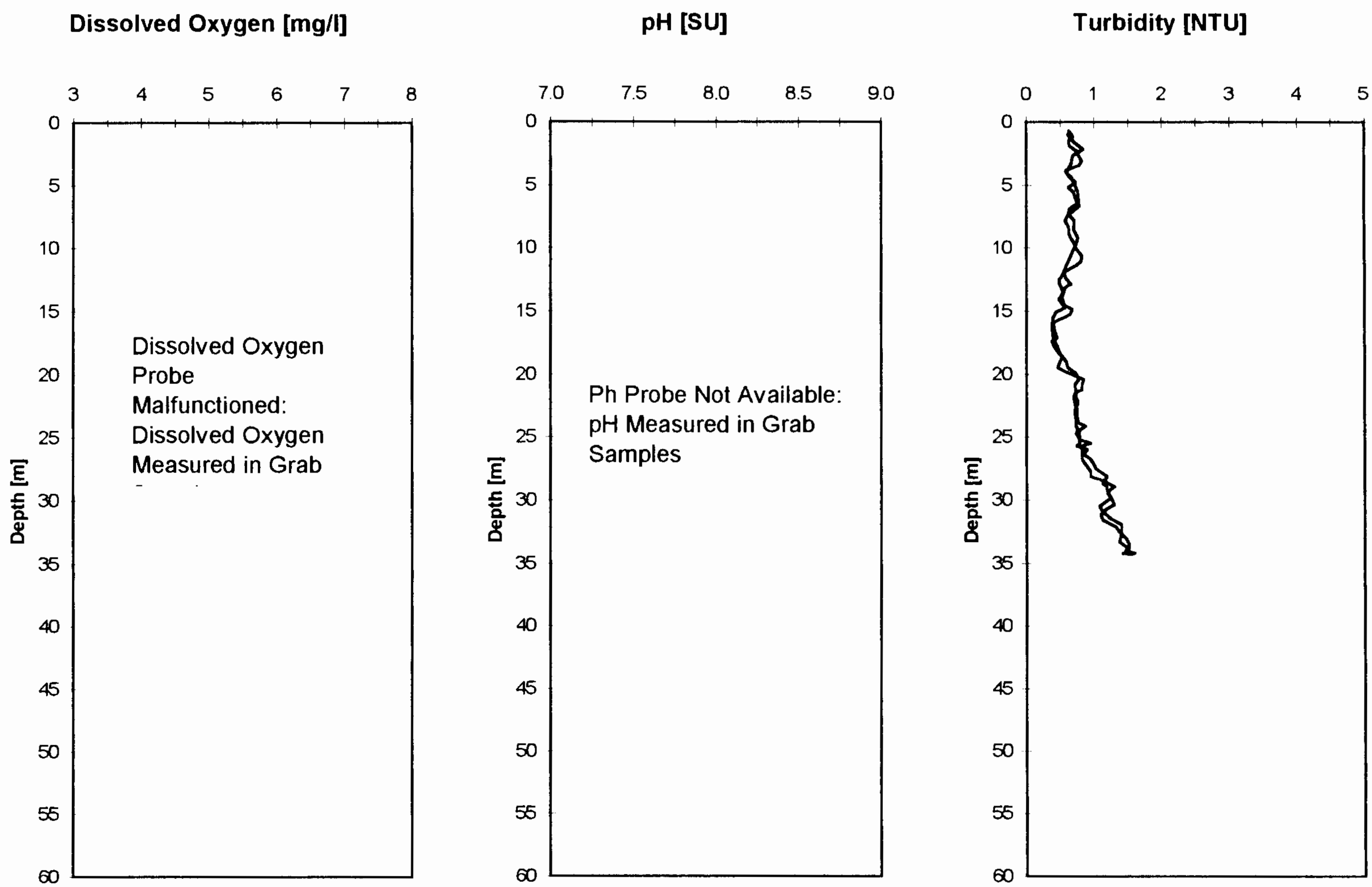
Station 8A
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



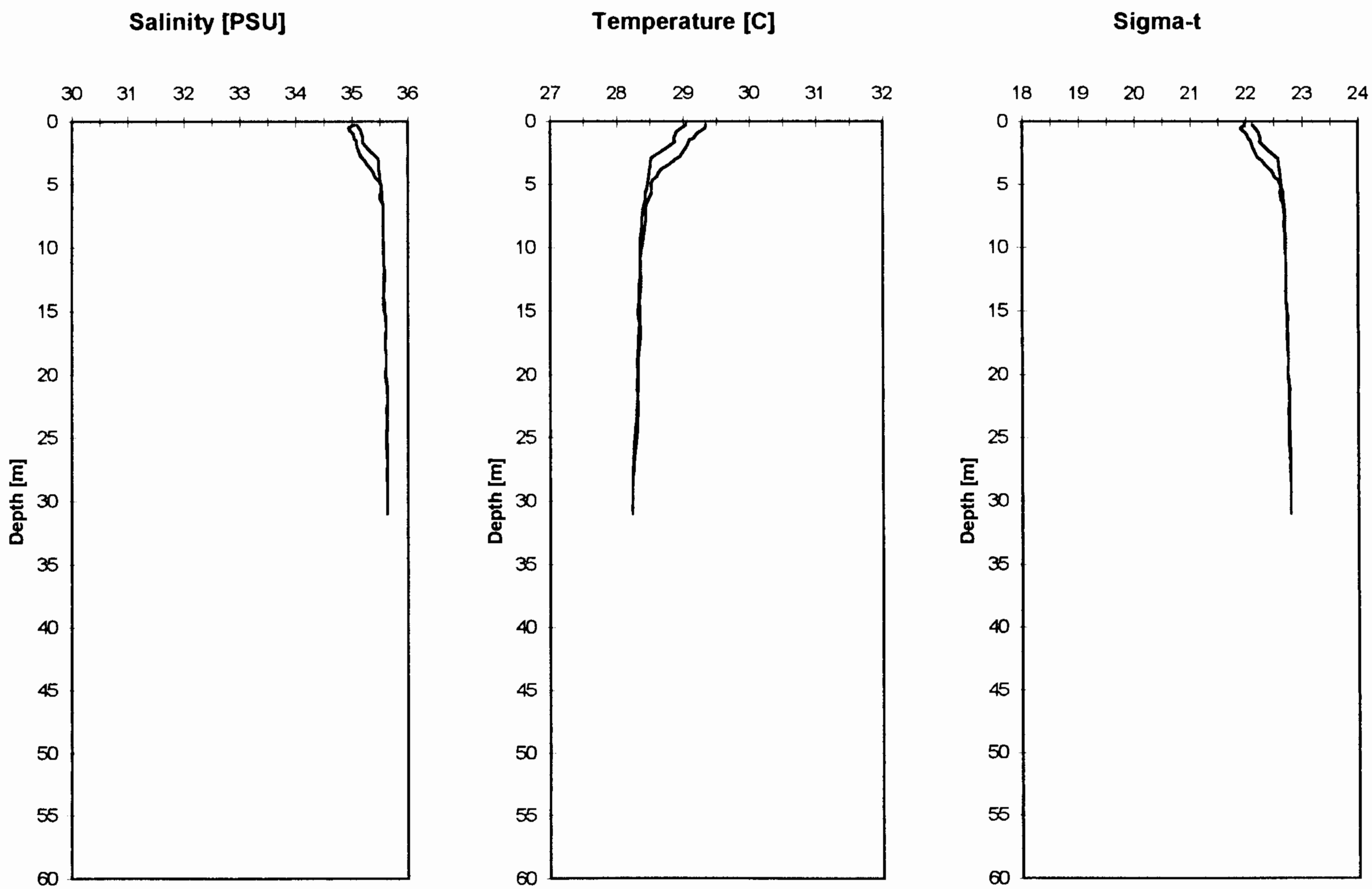
Station 8A
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



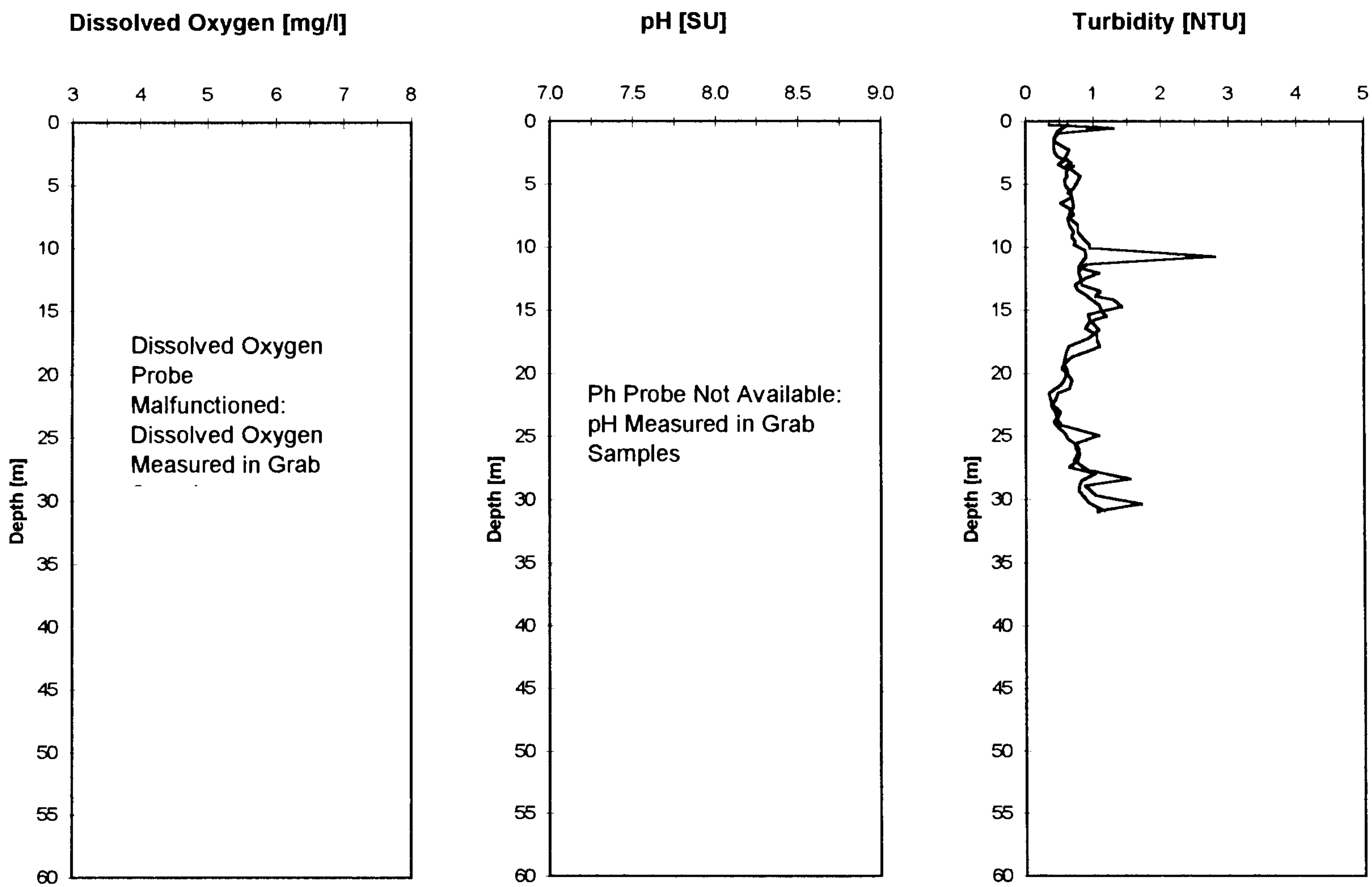
Station 9
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



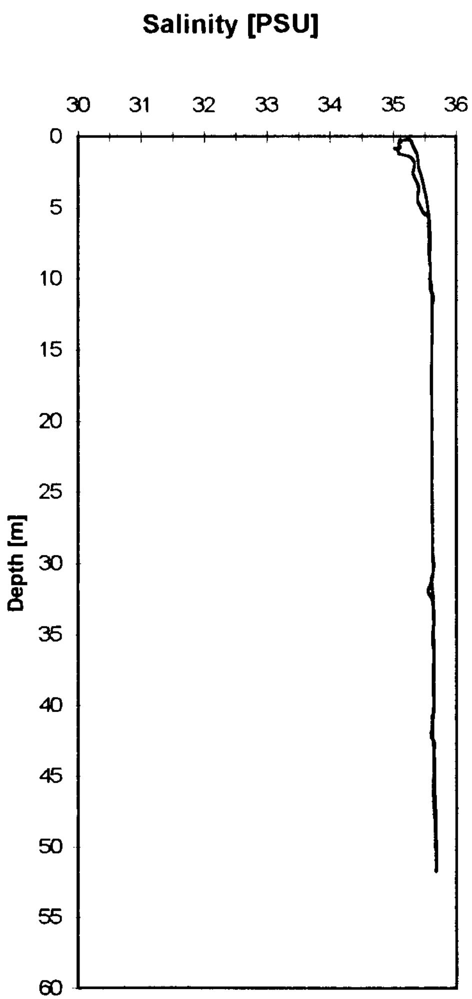
Station 9
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996

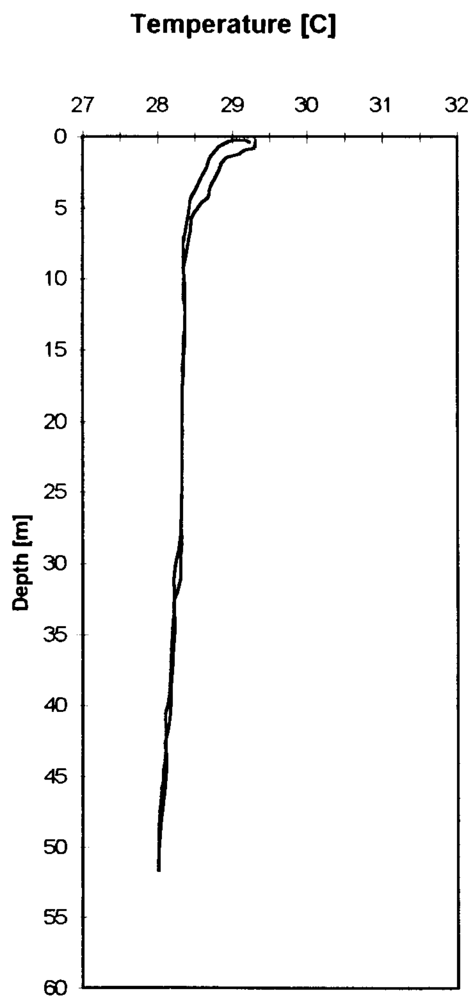


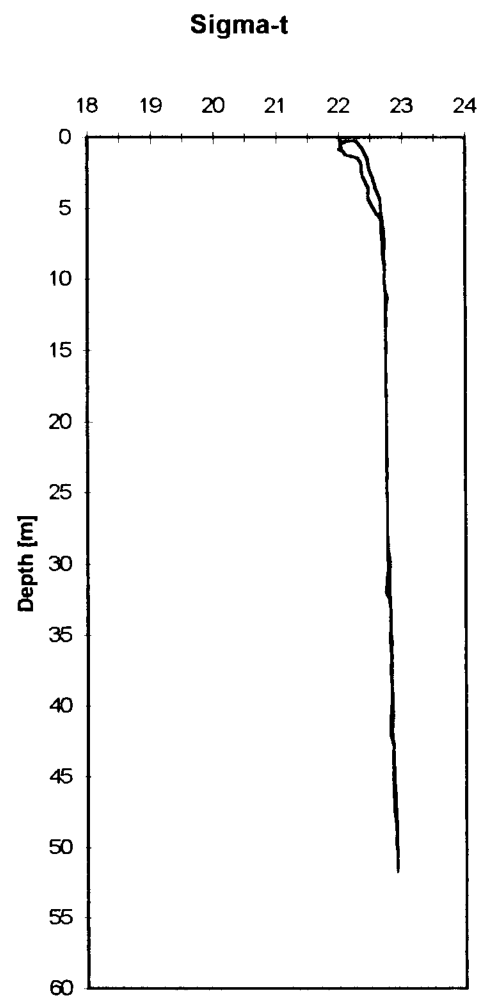
Station 9A
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



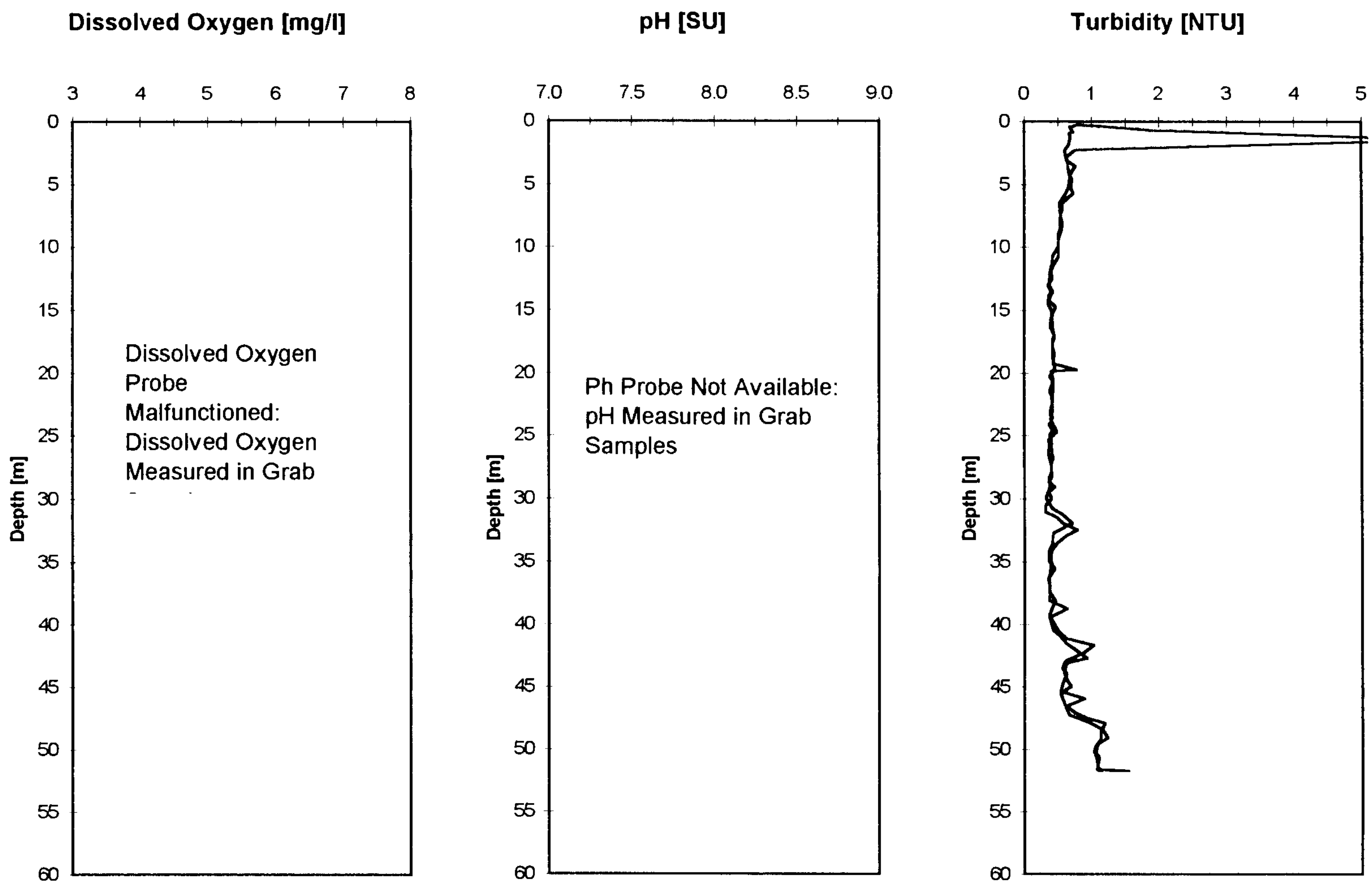
Station 9A
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



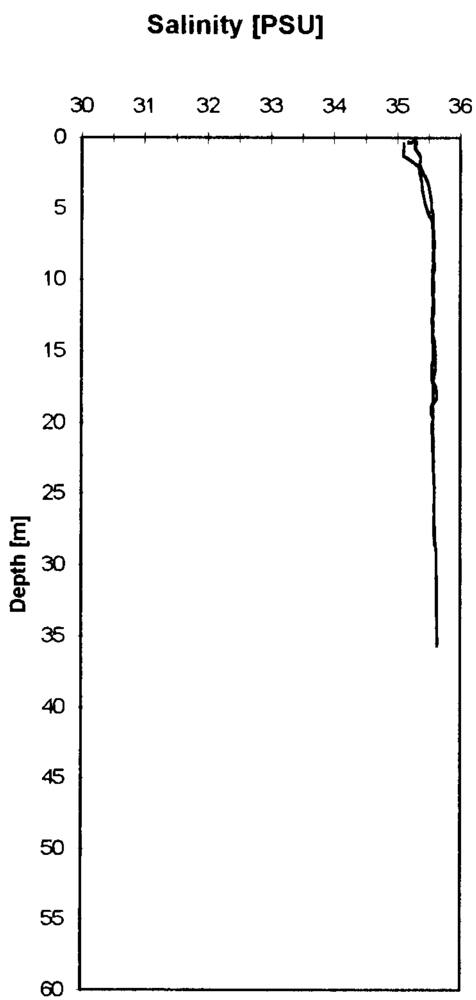


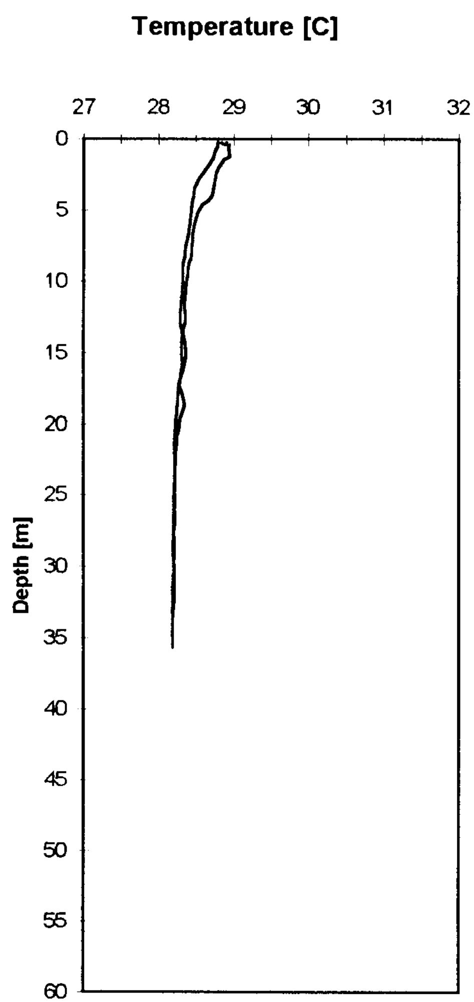


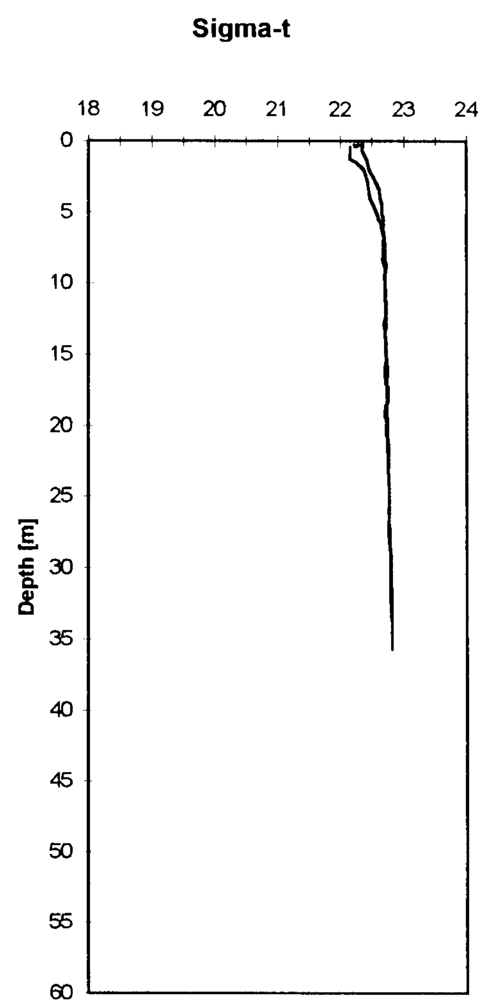
Station 10
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



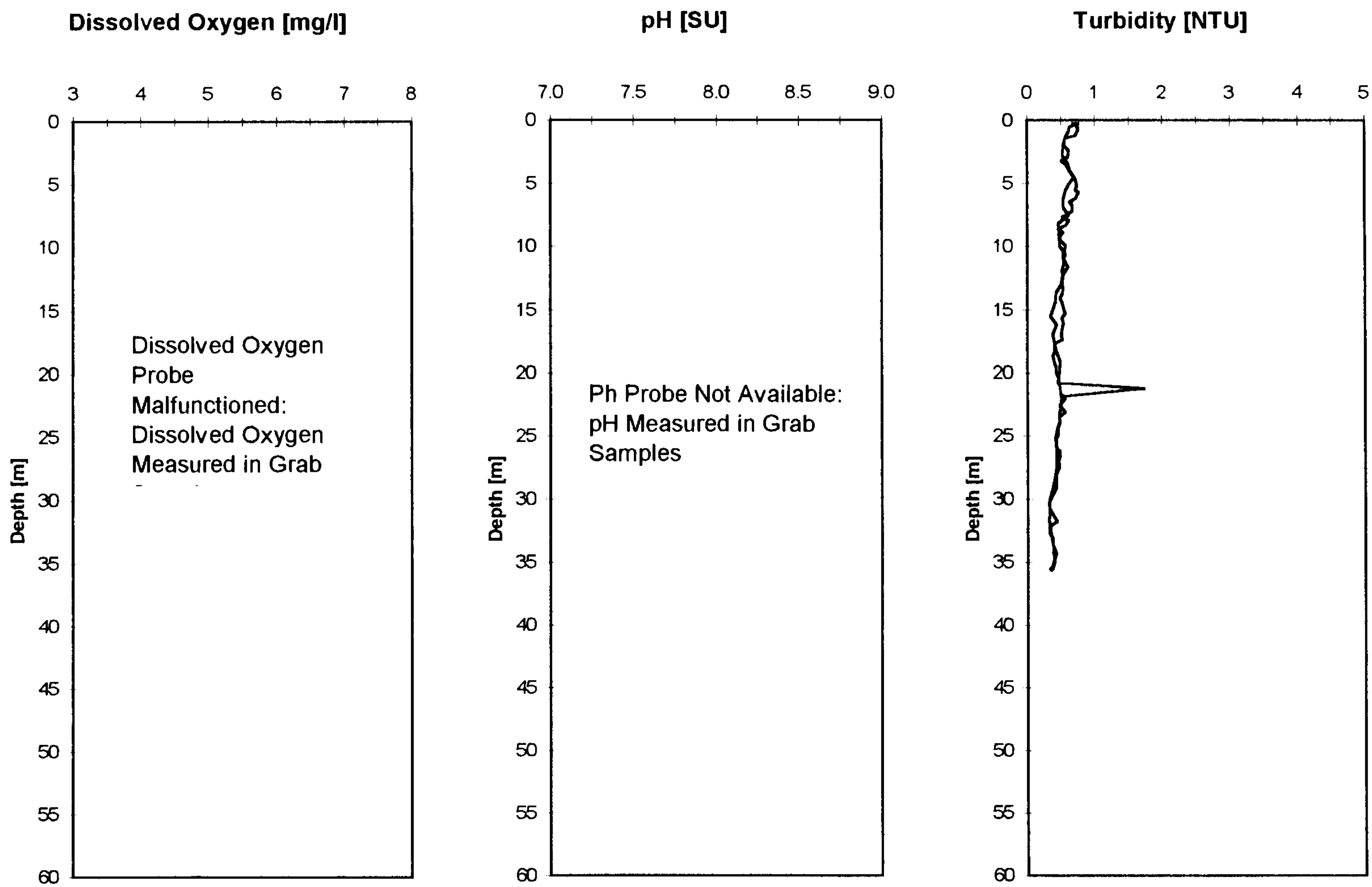
Station 10
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



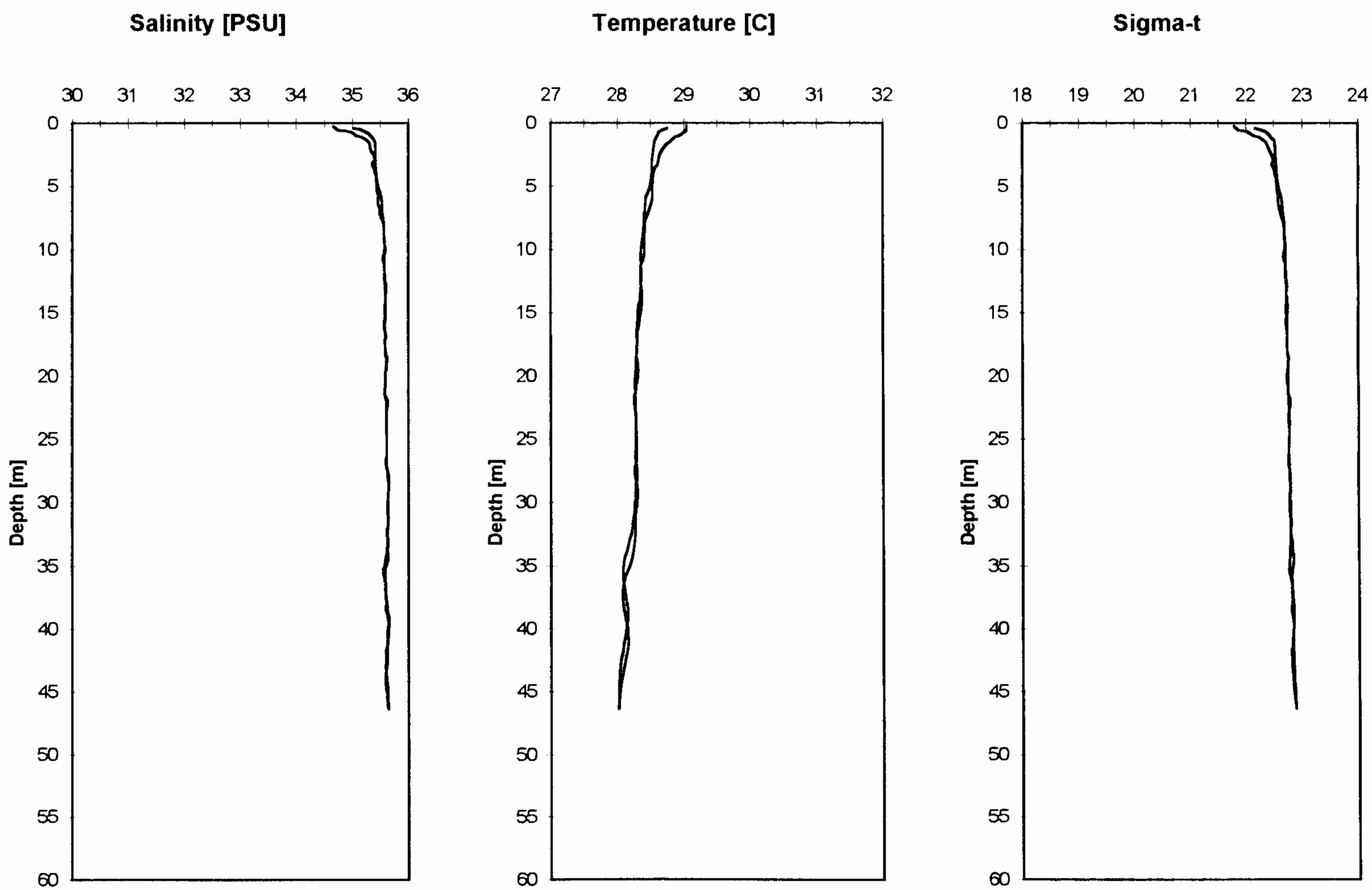




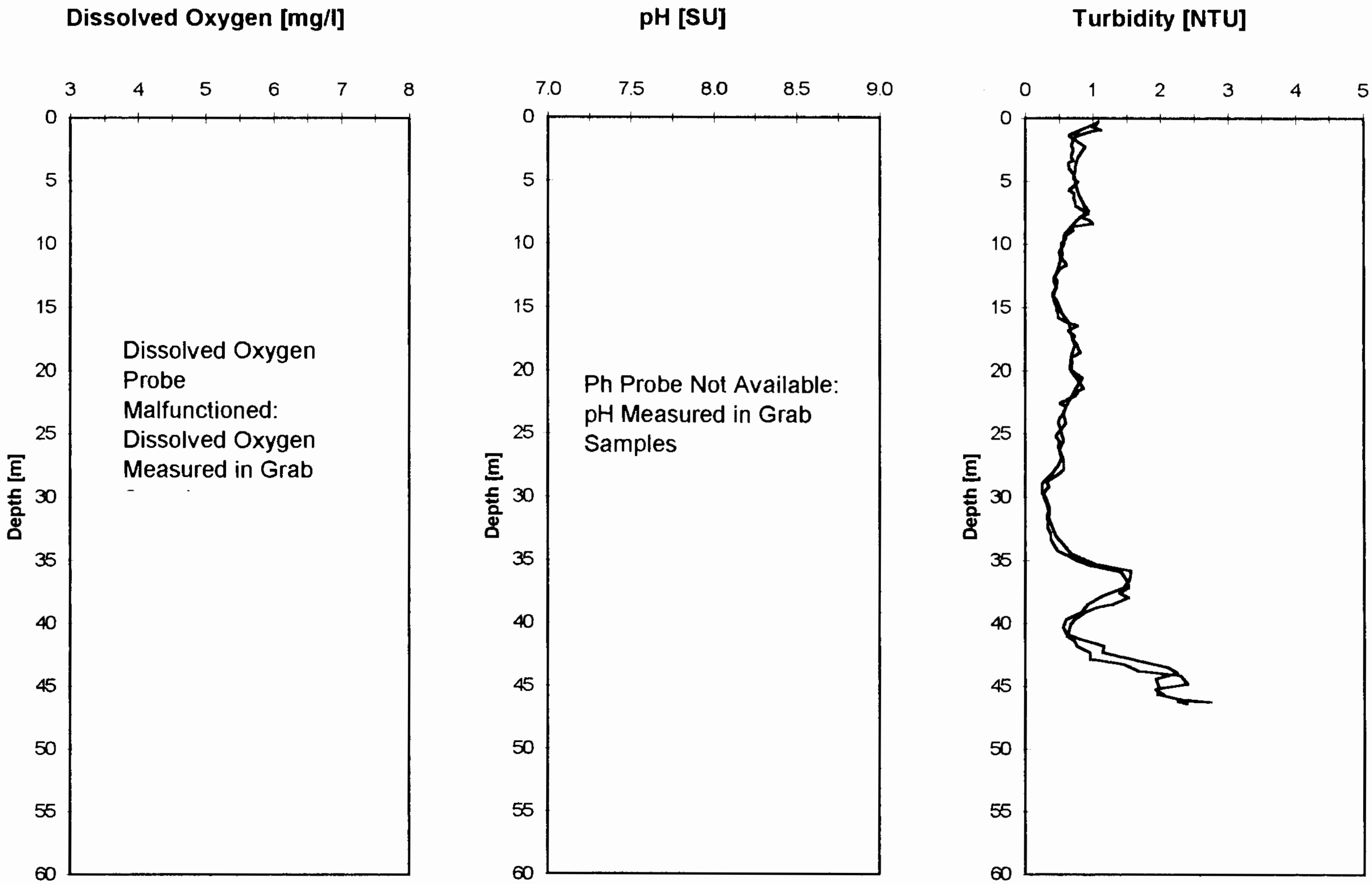
Station 10A
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



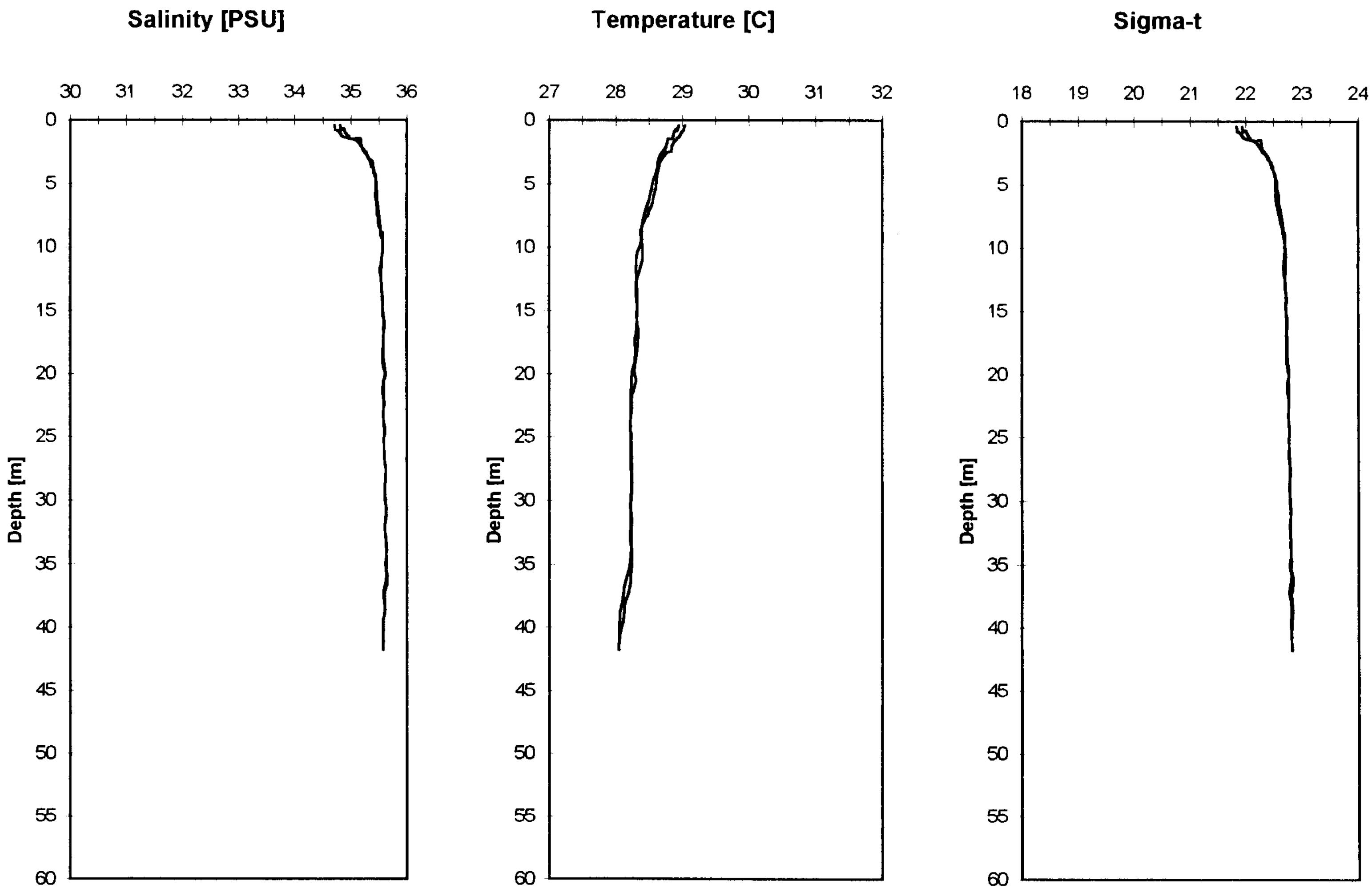
Station 10A
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



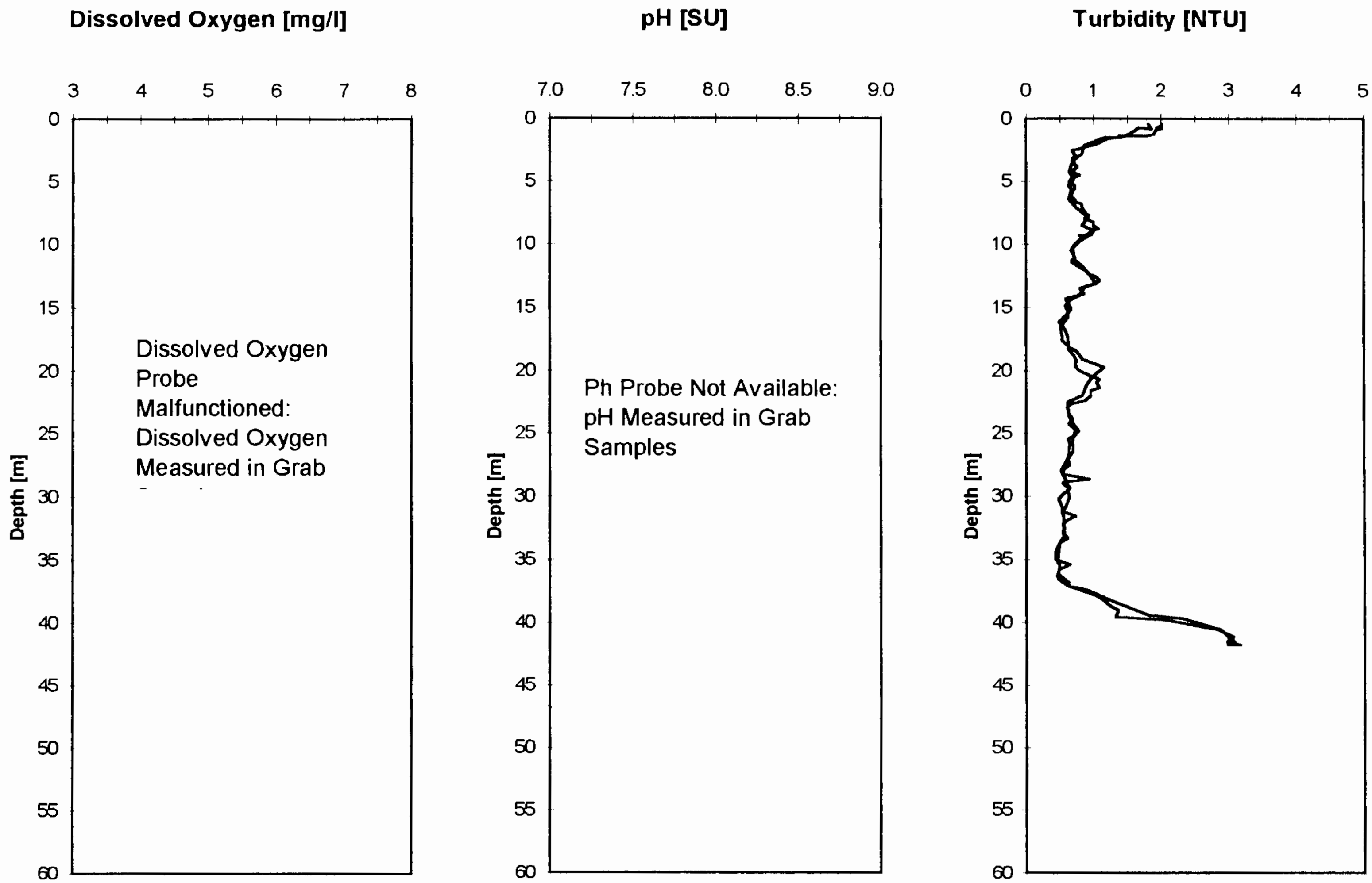
Station 11
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



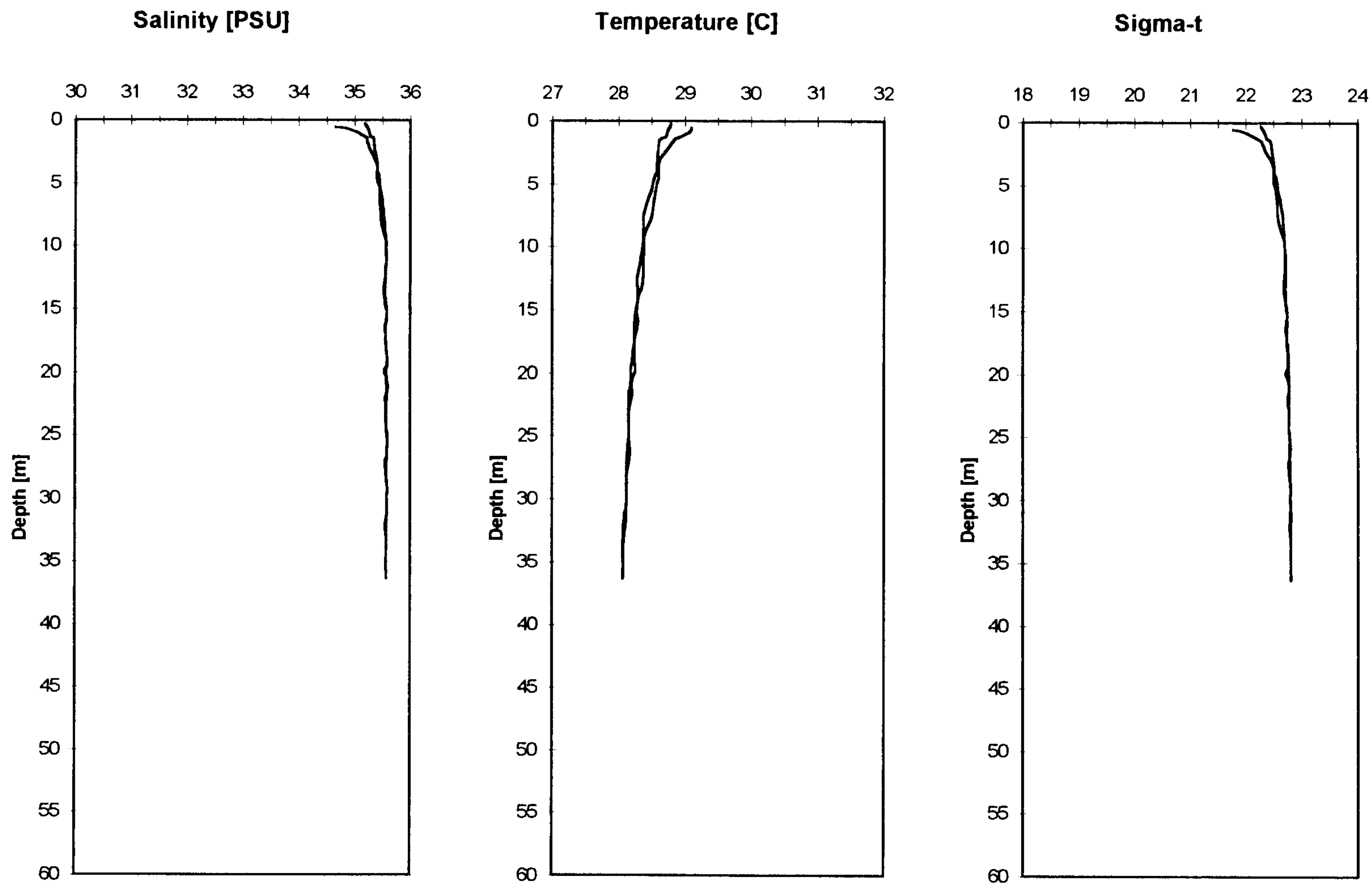
Station 11
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



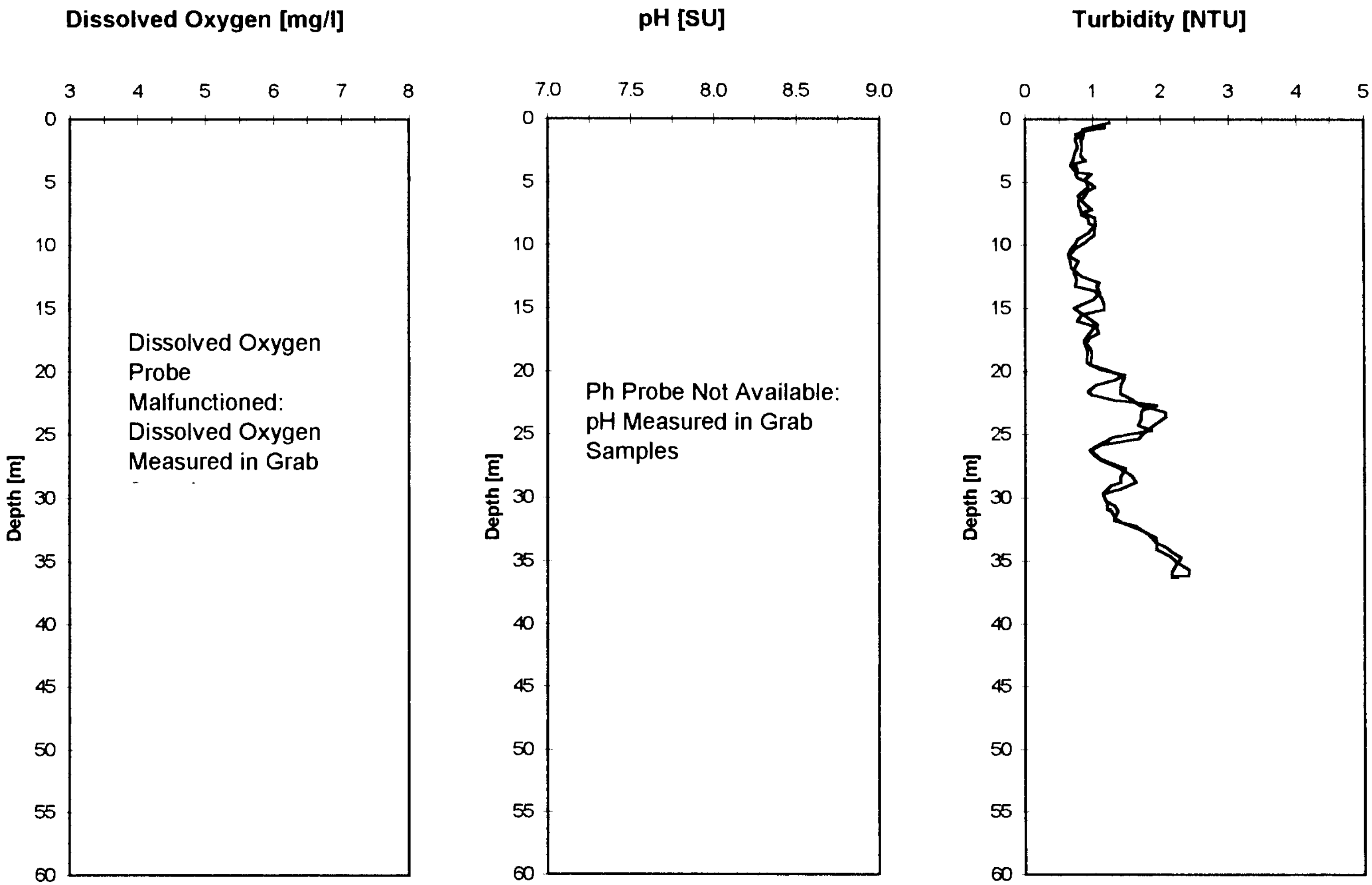
Station 11A
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



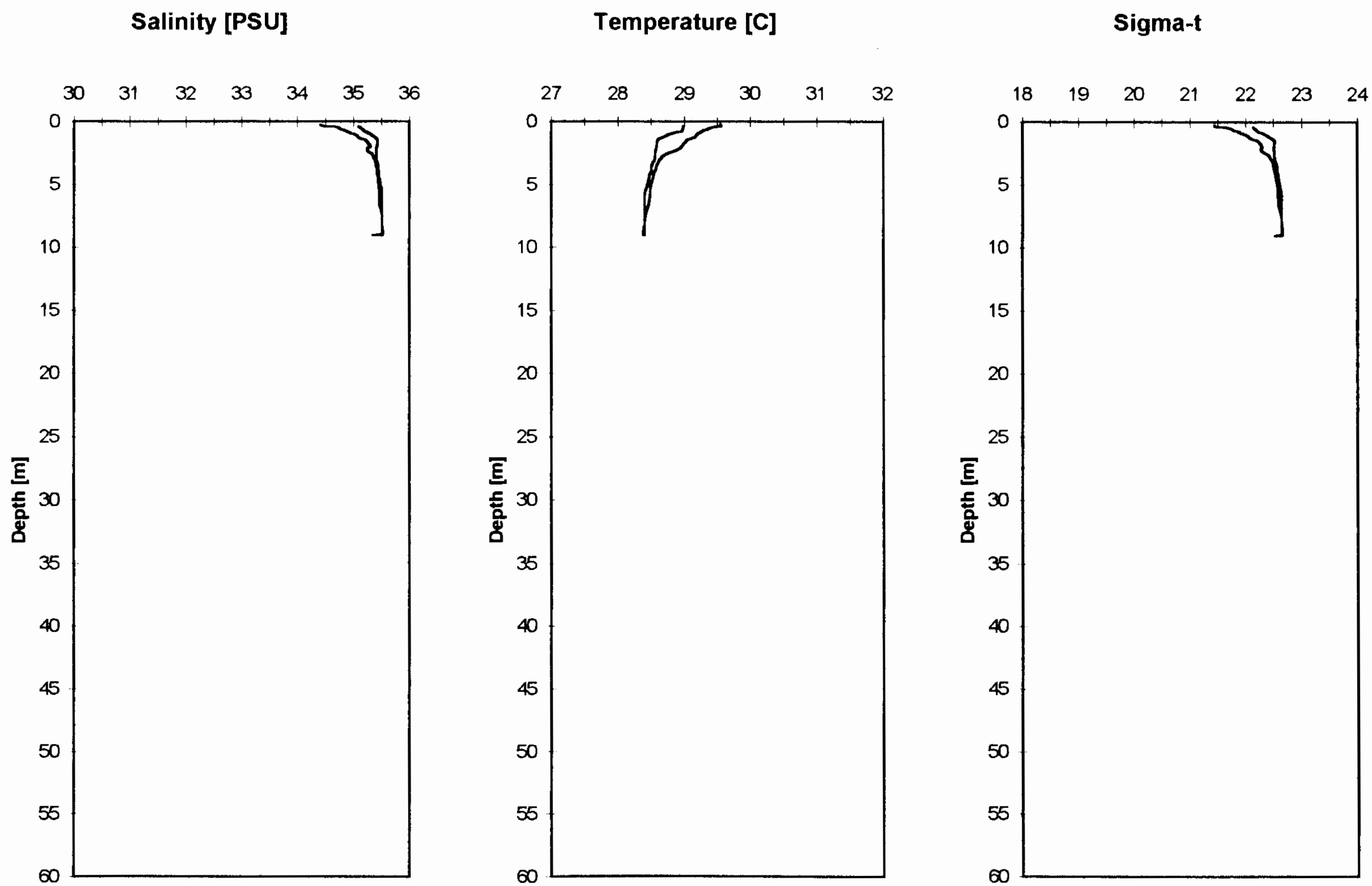
Station 11A
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



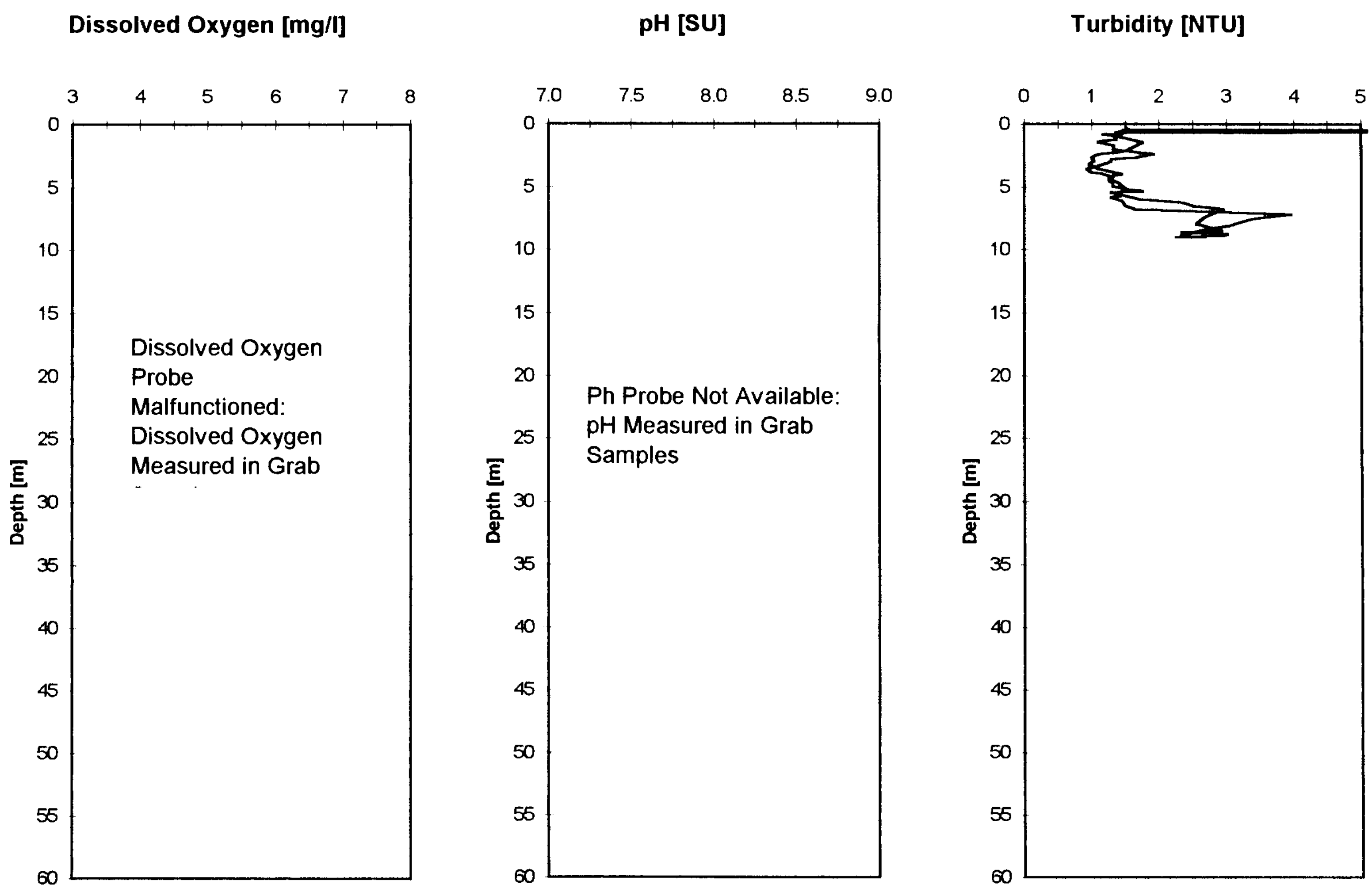
Station 12
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



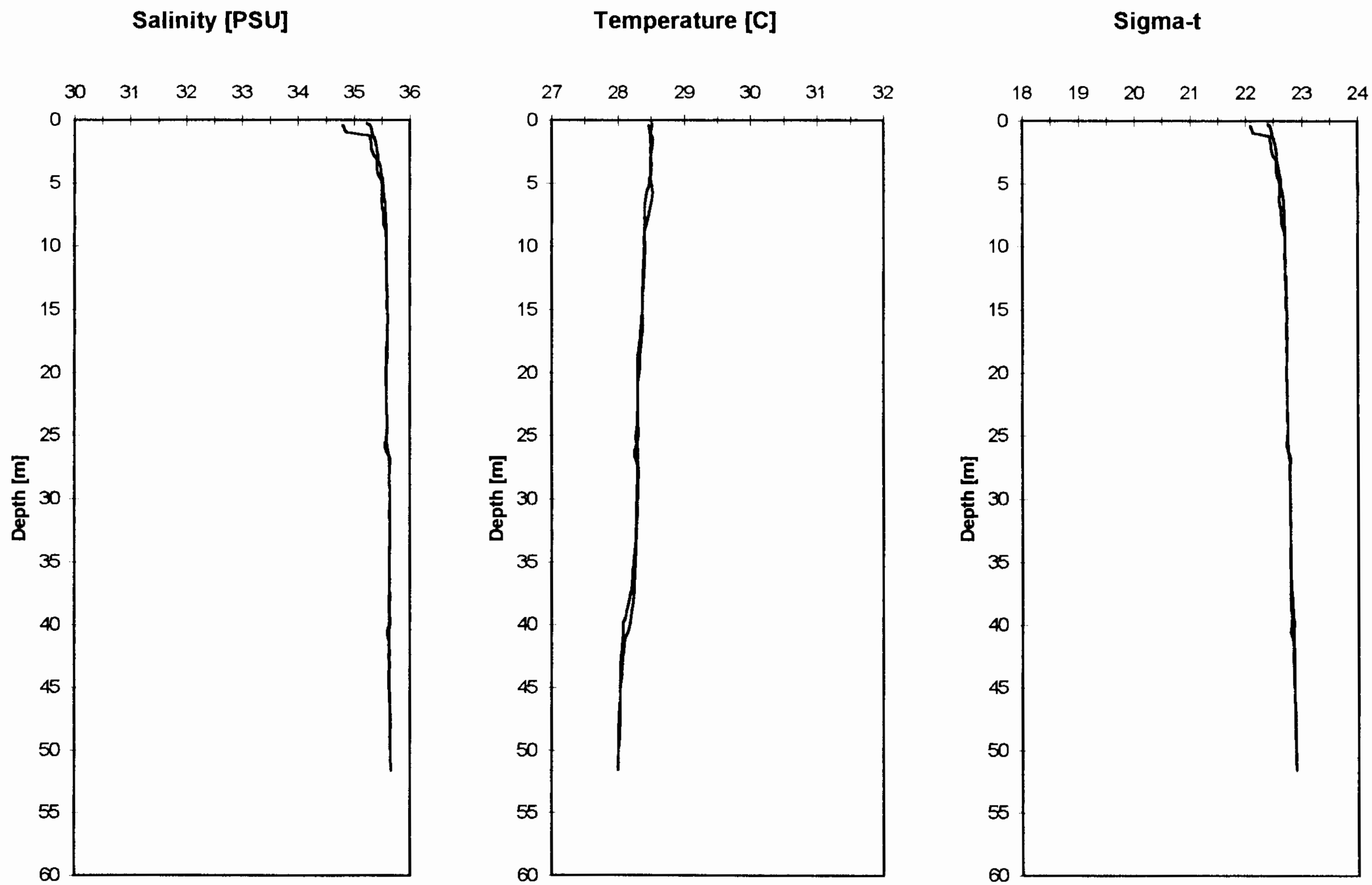
Station 12
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



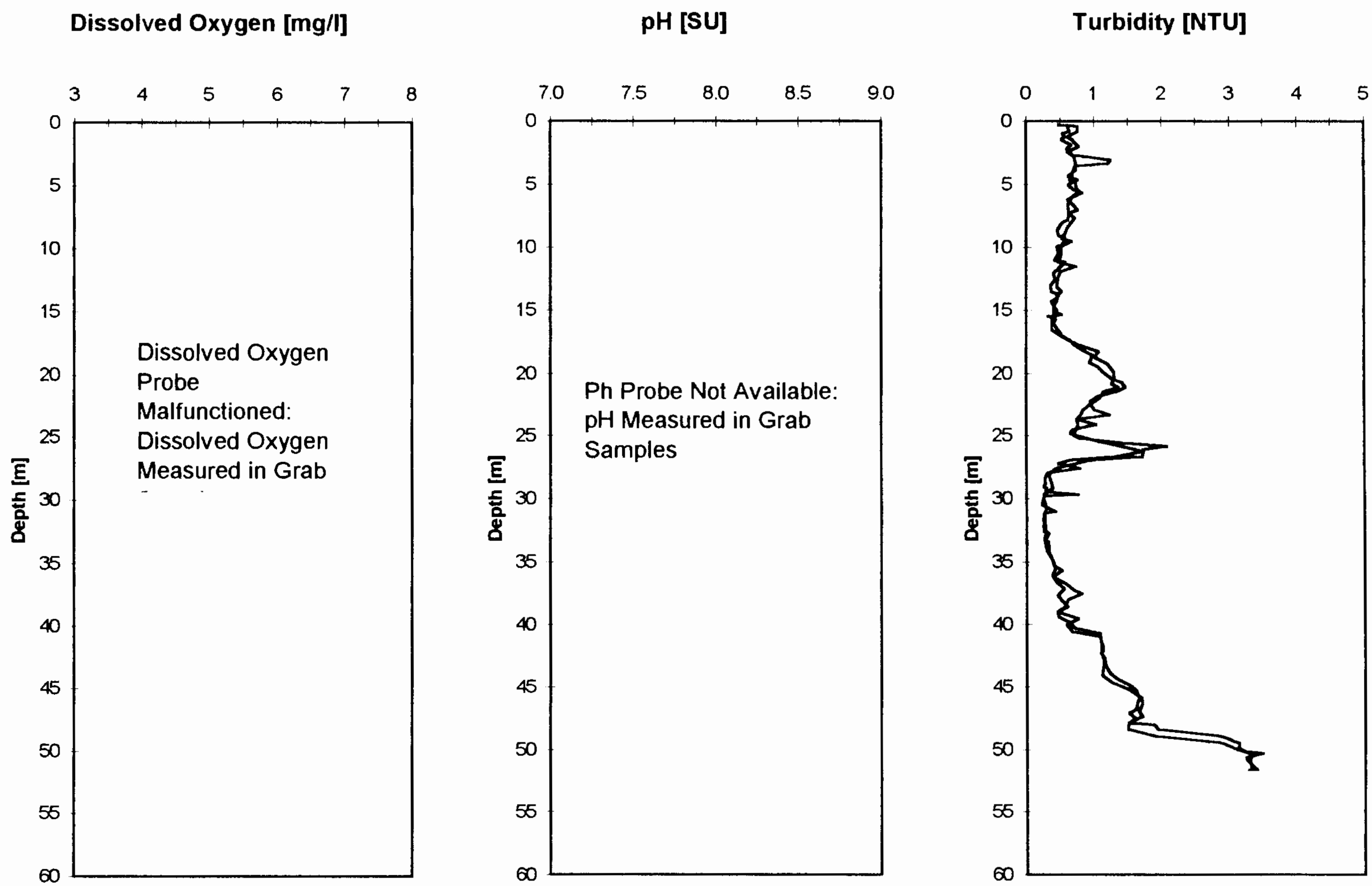
Station 13
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



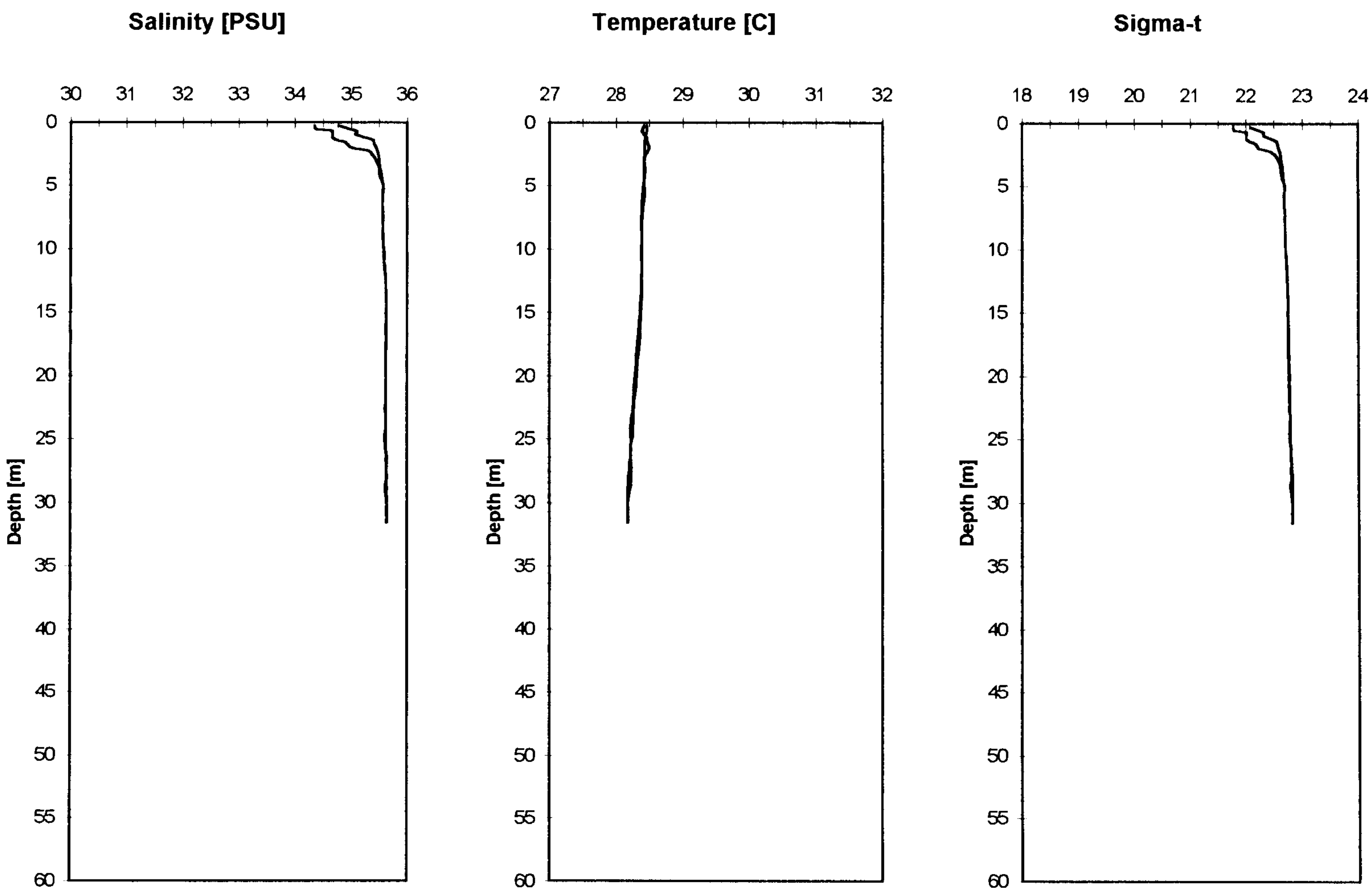
Station 13
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



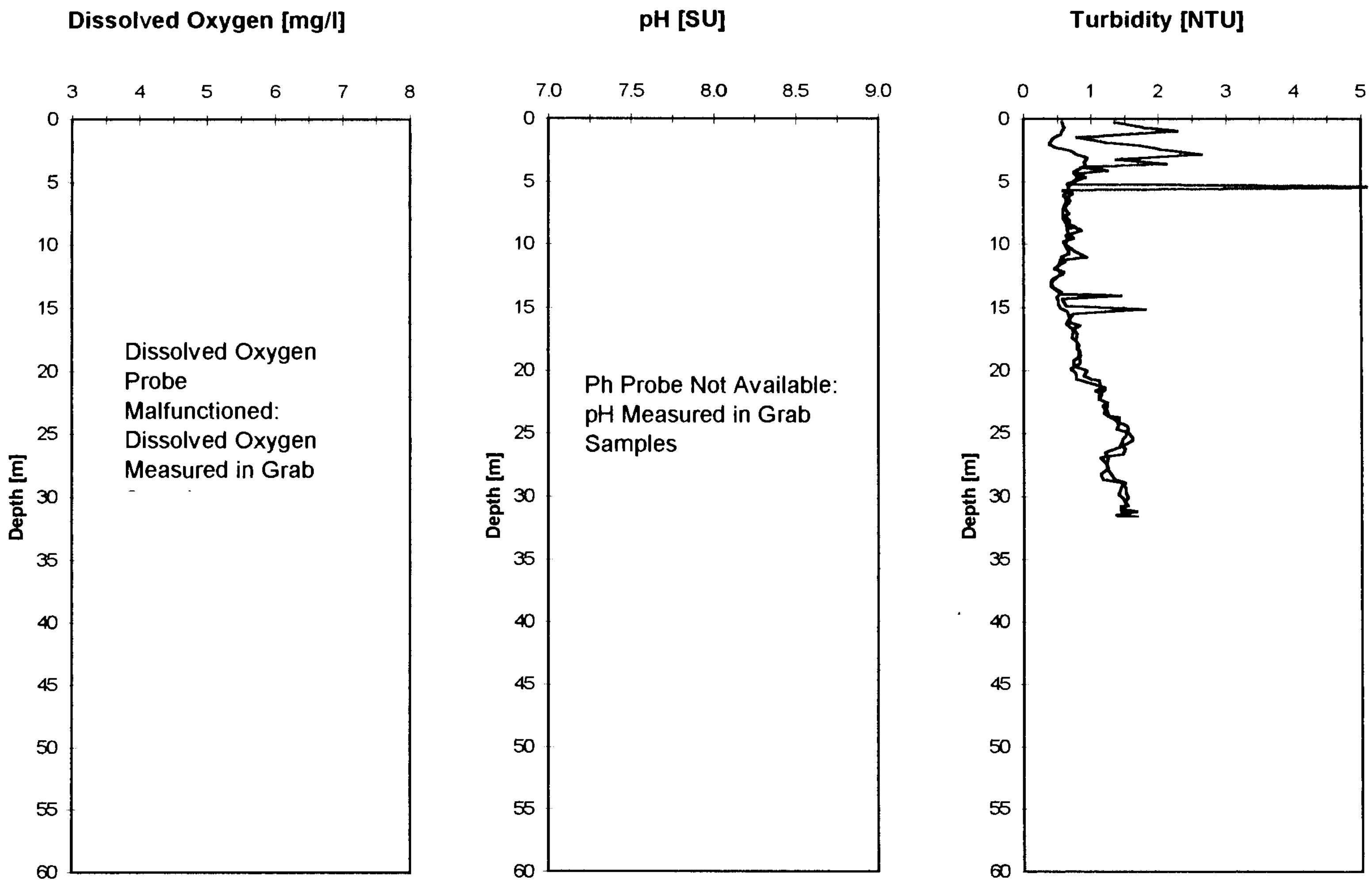
Station 14
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



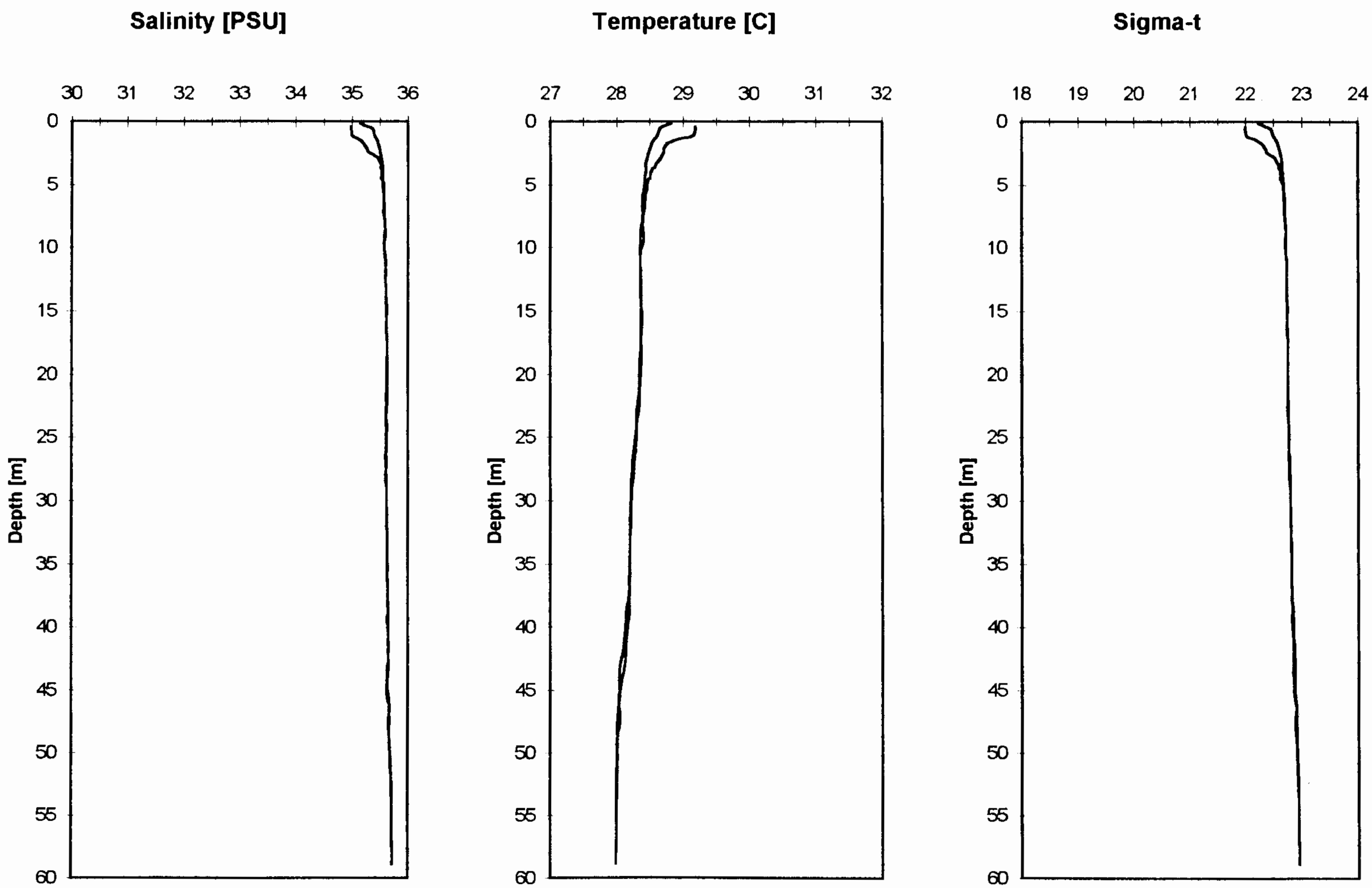
Station 14
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



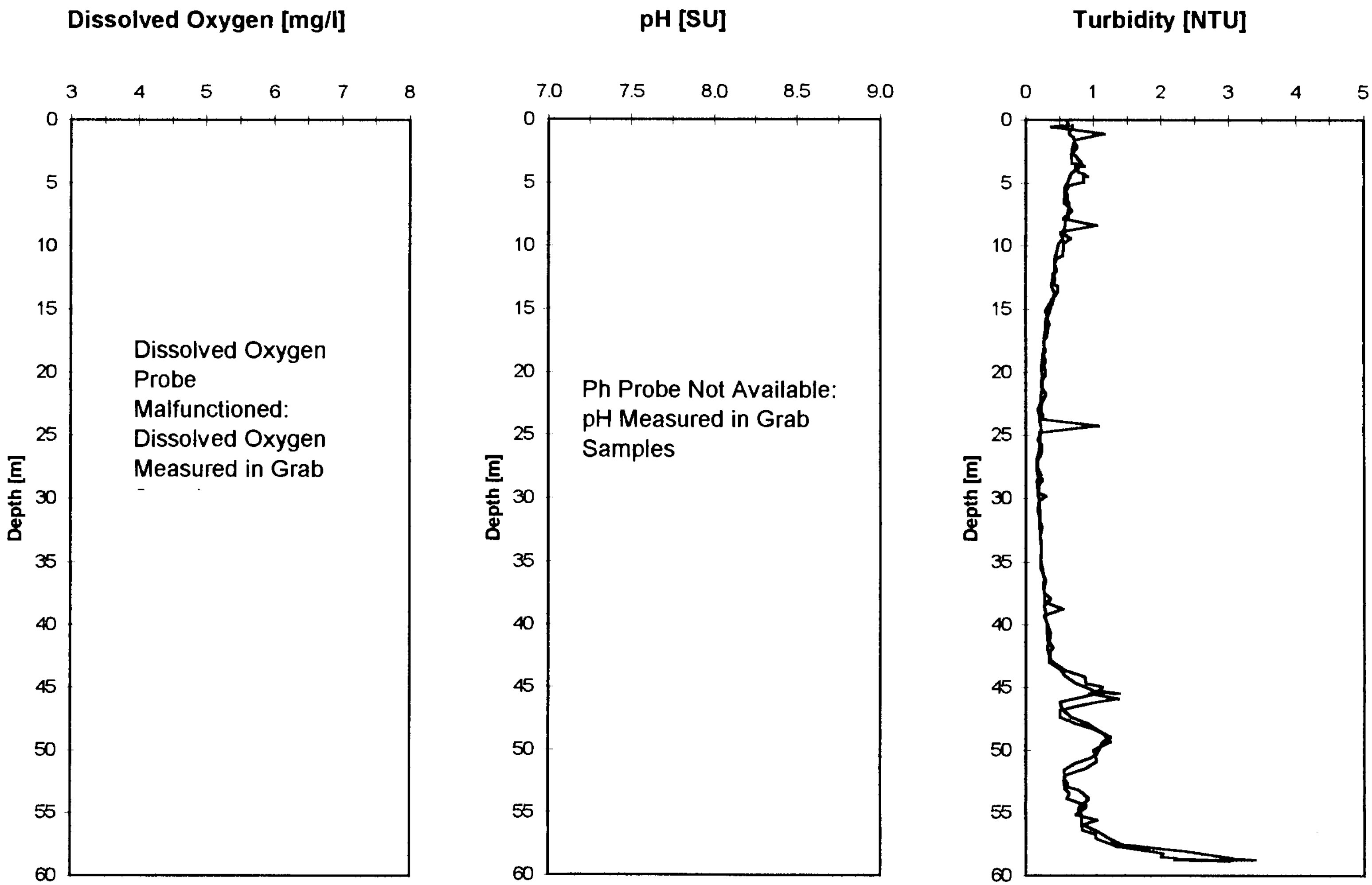
Station 15
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



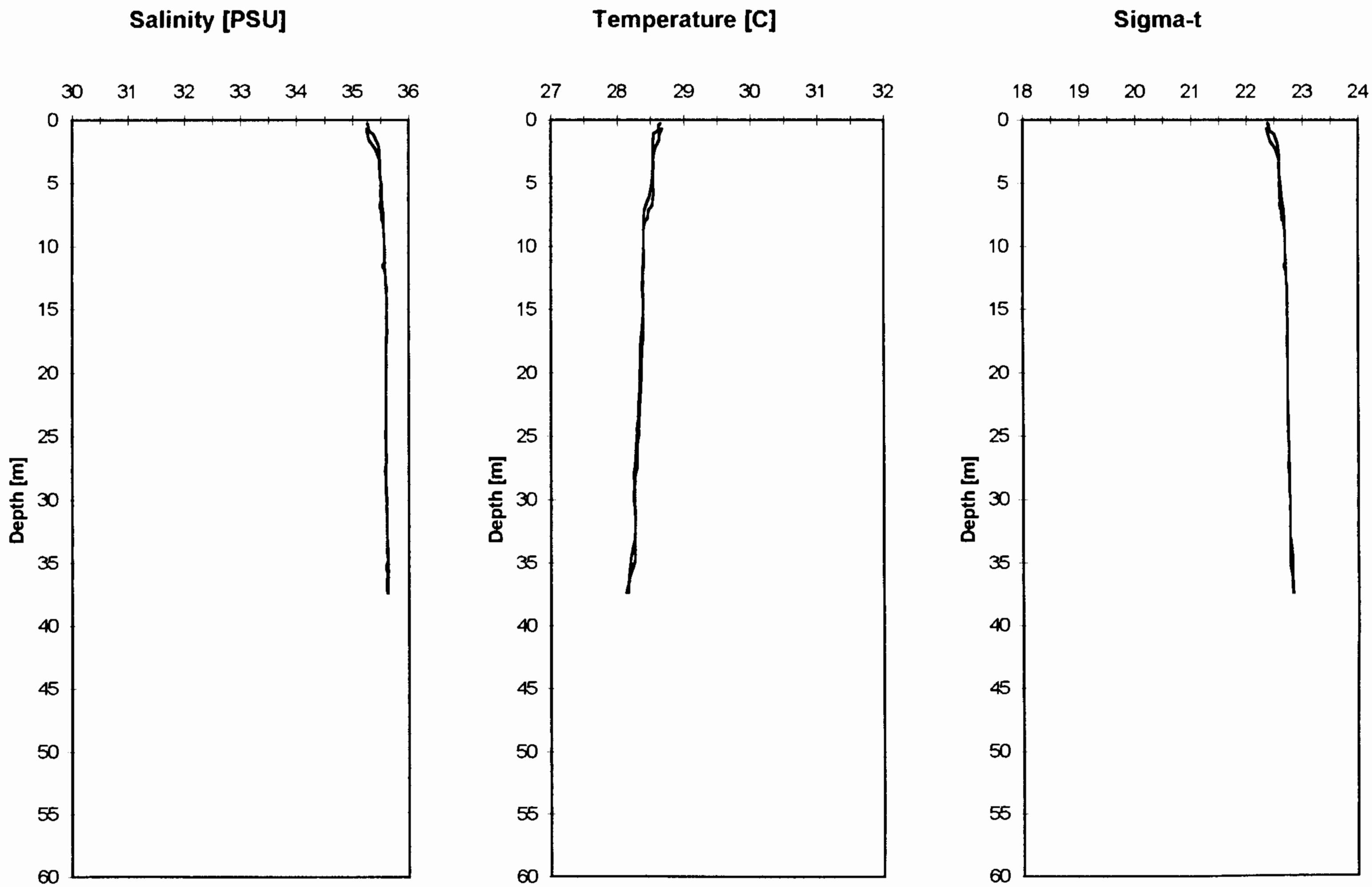
Station 15
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



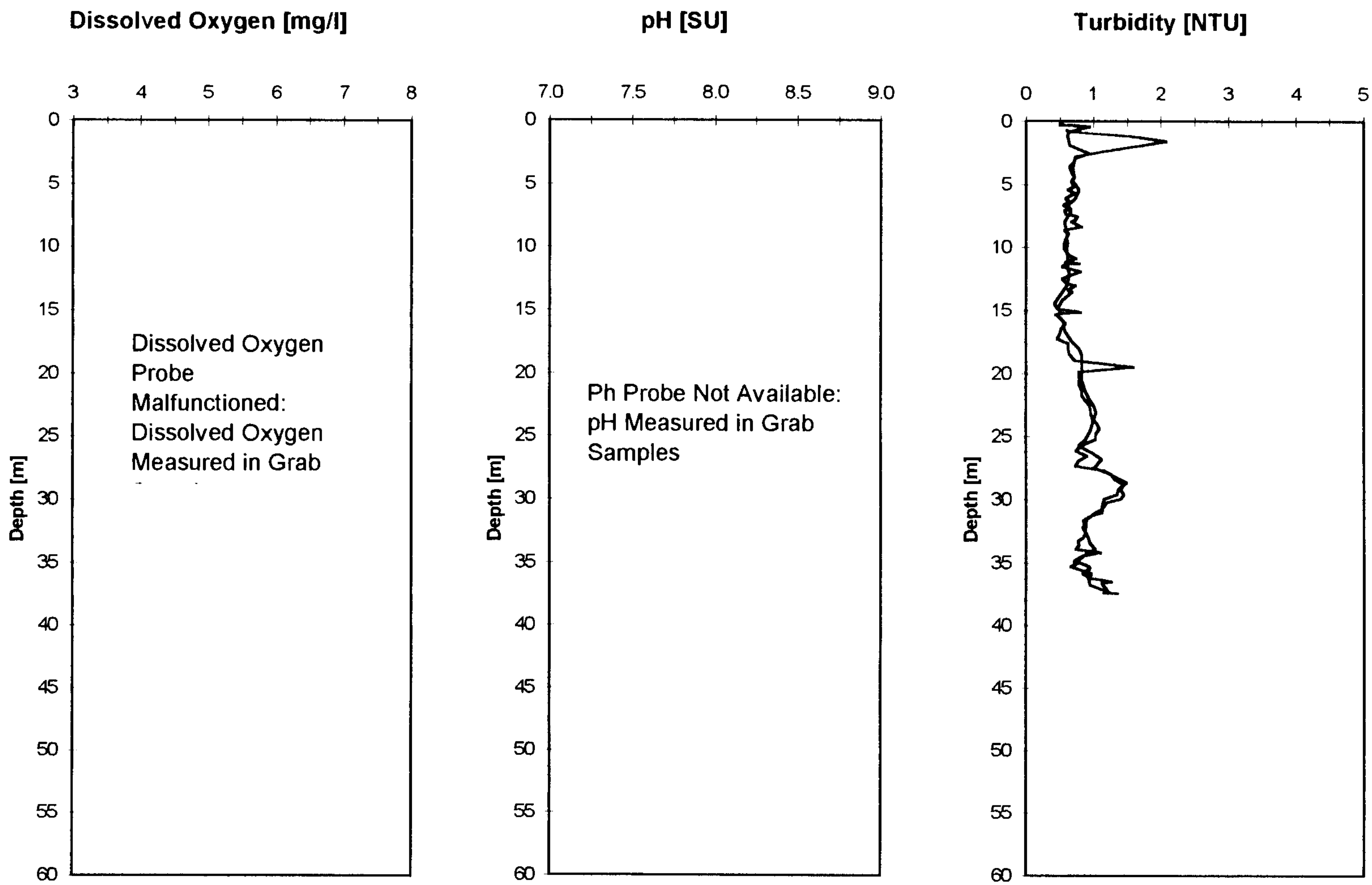
Station 16
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



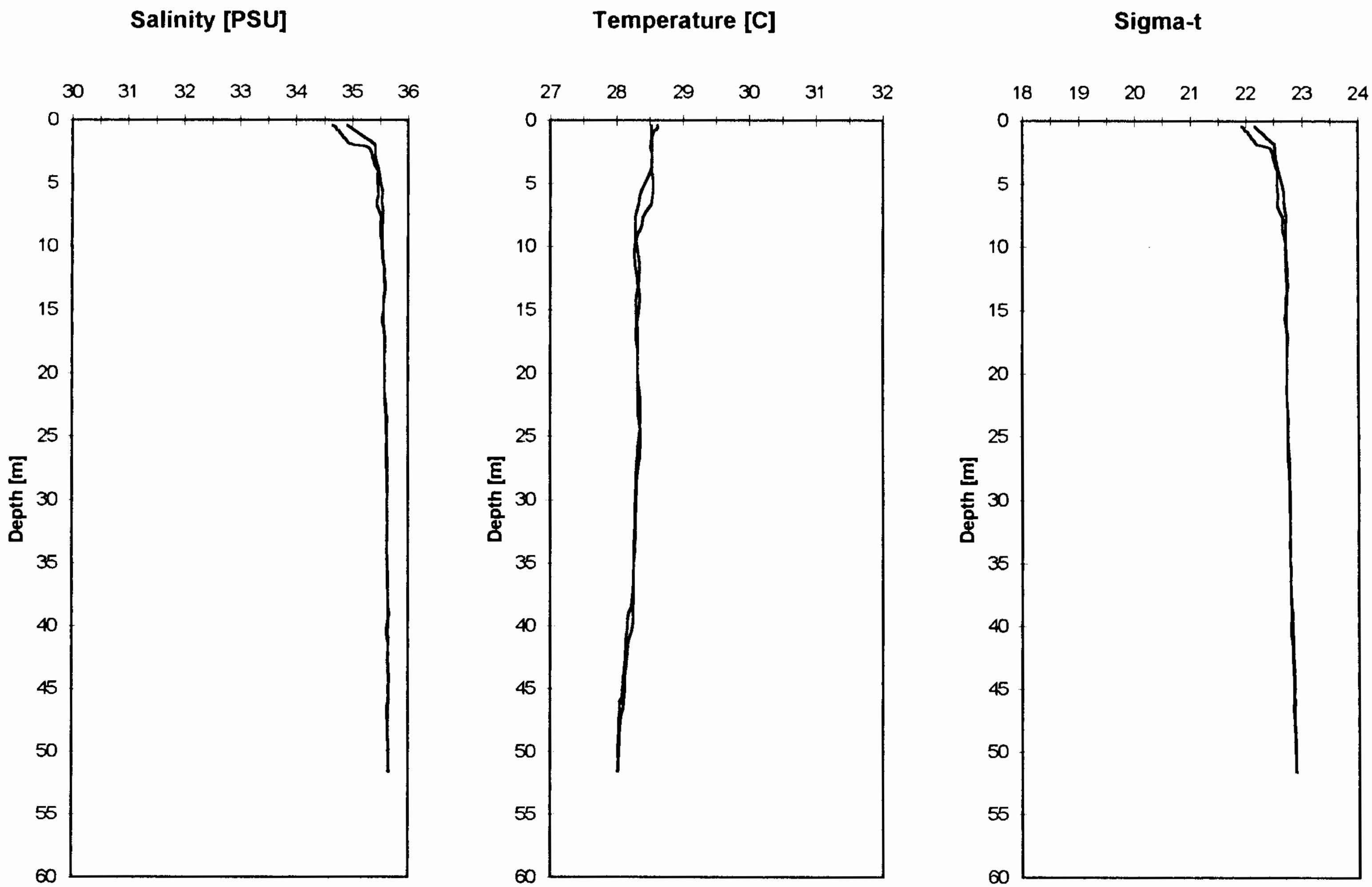
Station 16
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



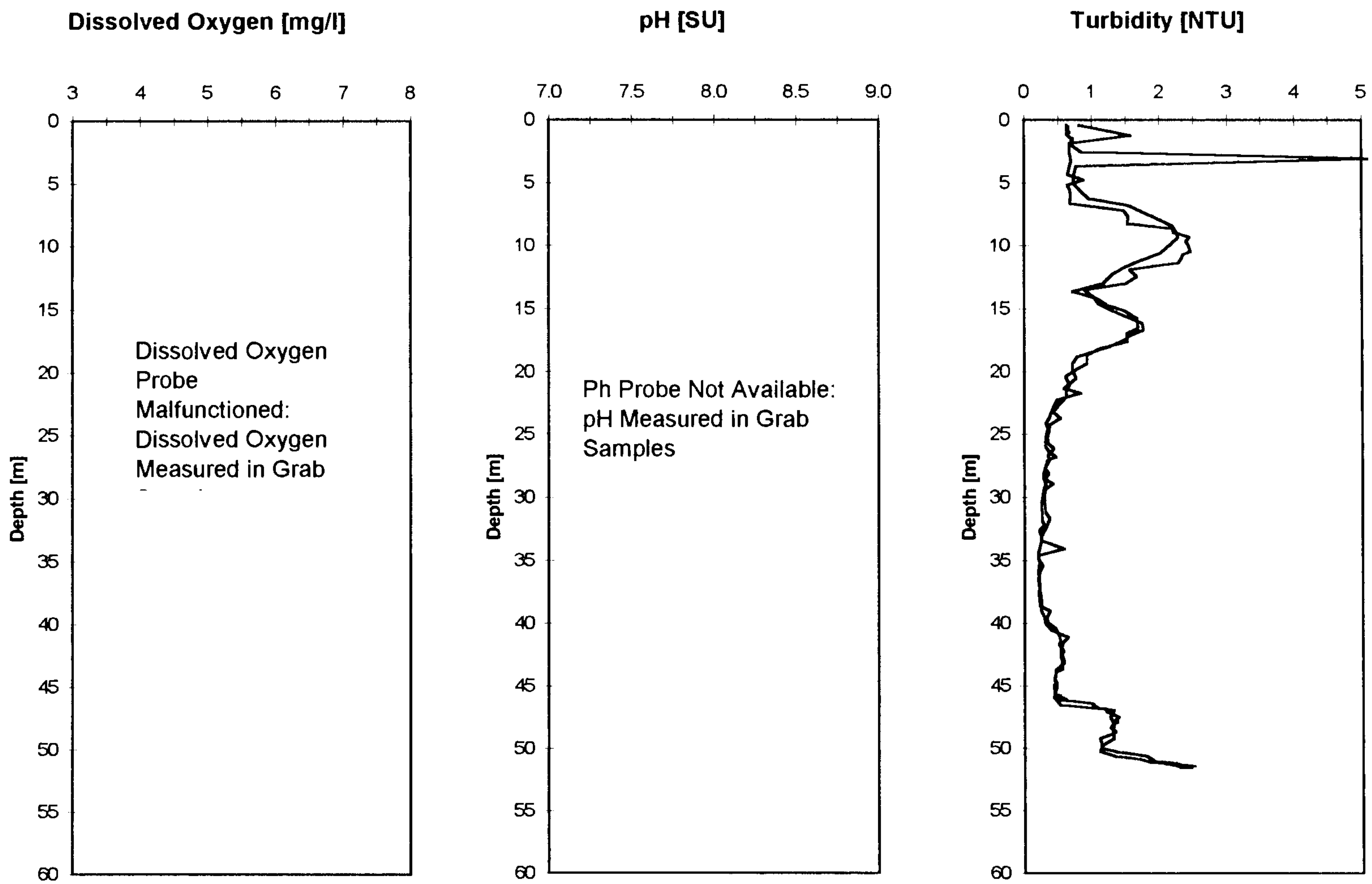
Station 17
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



Station 17
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996



Station 18
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
23 November 1996



Station 18
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
23 November 1996

Appendix IV

Chain of Custody Records

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091.WQ.96
Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-~~826~~-0717

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

ANALYSES REQUESTED

SHADED AREA– FOR LAB USE ONLY

Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	AMMONIA (350.1)	NITRATE (353.2)	NITRITE (353.2)	TKN @ DL of 0.05mg/l (351.3)	TOTAL PHOSPHORUS (365.2)	REMARKS	LAB 1 ID	LAB 2 ID
11/96				X			5-BOTM	163152	X	X	X	X	X	SEAWATER		
							5-~~[illegible]~~120	316								
							5-90	317								
							5-60	318								
							5-30	319								
							5-SURF	320								
							5A-BOTM	321								
							5A-120	322								
							5A-90	323								
							5A-60	324								
							5A-30	325								

Sampled By & Title (Please sign and print name): S. Costa 11/96 | Date/Time:

Relinquished By (Please sign and print name): S. Costa 11/22/96 | Date/Time:

Received By (Please sign and print name): M. Brown | Date/Time: 11/25/96

Relinquished By (Please sign and print name): | Date/Time:

Received By (Please sign and print name): | Date/Time:

Relinquished By (Please sign and print name): | Date/Time:

QC Level: 1 2 3 Other: ____

COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Received By (Please sign and print name): | Date/Time:

Shipped Via: UPS BUS Fed-Ex Hand Other DHL

Shipping #:

Work Authorized By (Please sign and print name):

Remarks: TKN @ DL of 0.05mg/l DO NOT RUN TURBIDITY ON THESE

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/94 FORM 340

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091.WQ.96
Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA
Report Copy to:

Requested Completion Date:
Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____
Sample Disposal: Dispose [ ] Return [ ]

OF CONTAINERS

LAB TEST CODES

ANALYSES REQUESTED: AMMONIA (350.1); NITRATE (353.2); NITRITE (353.2); TKN (351.3) @ DL of 0.05 mg/l; TOTAL PHOSPHORUS (356.2)

SHADED AREA – FOR LAB USE ONLY
Lab 1 #: | Lab 2 #:
Quote #: | Kit Request #:
Project #:
No. of Samples: | Page of
Login: | LIMS Ver

Date	Time	COMP	GRAB	WATER	SOIL	AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	AMMONIA (350.1)	NITRATE (353.2)	NITRITE (353.2)	TKN (351.3) @ DL of 0.05 mg/l	TOTAL PHOSPHORUS (356.2)	REMARKS	LAB 1 ID	LAB 2 ID
11/96				X			5A-SURF 163262	2	X	X	X	X	X	SEAWATER		
							6-BOTM 327									
							6-120 328									
							6-90 329									
							6-60 330									
							6-30 331									
							6-SURF 332									
							6A-BOTM 333									
							6A-60 334									
							6A-30 335									
							6A-SURF 336									

Sampled By & Title (Please sign and print name): S.Costa 11/1/96 | Date/Time
Relinquished By (Please sign and print name): S.Costa 11/22/96 | Date/Time
Received By (Please sign and print name): M. Ben | Date/Time 11/25
Relinquished By (Please sign and print name) | Date/Time
Received By (Please sign and print name) | Date/Time
Relinquished By (Please sign and print name) | Date/Time
QC Level: 1 2 3 Other:
COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph
Received By (Please sign and print name) | Date/Time
Shipped Via: UPS BUS Fed-Ex Hand Other DHL
Shipping #
Work Authorized By (Please sign and print name)
Remarks: TKN @ DL of 0.05 mg/l – NO TURBIDITY TEST ON THESE

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client
REV 2.91 FORM 210

QAL QUALITY ANALYTICAL LABORATORIES, INC.

THESE SAMPLES IN ANCILLARY COOLER (WITH STATIONS 11, 11A, 12, 13

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

Project #	107091. ~~EL.04~~ WQ.96
Purchase Order #	
Project Name	JCO HARBOR MONITORING
Company Name	CH2M HILL
Project Manager or Contact & Phone #	STEVE COSTA 707-826-7662
Report Copy to:	
Requested Completion Date:	
Site ID	
Sample Disposal:	☐ Dispose ☐ Return

☐ LGN
One Innovation Drive, Suite C
Alachua, FL 32615-9586
(904) 462-3050 FAX (904) 462-1670

☐ LRD
5090 Caterpillar Road
Redding, CA 96003-1412
(916) 244-5227 FAX (916) 244-4109

☐ LMG
2567 Fairlane Drive
Montgomery, AL 36116-1622
(334) 271-2440 FAX (334) 271-3428

☐ LKW
Canviro Analytical Laboratories, Inc.
50 Bathurst, Unit 12
Waterloo, Ontario, Canada N2V 2C5
(519) 747-2575 FAX (519) 747-3806

THIS AREA FOR LAB USE ONLY

Lab #	Page	of
Client Service	Price Source A P Q S	
Acct Code	Test Group	
Project Code	Ack. Gen.	
LIMS Ver	Login	Mult.
COC Review		

ANALYSES REQUESTED

Sampling Date	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	QC ID (3 CHAR)	# OF CONTAINERS	AMMONIA (350.1)	NITRATE (353.2)	NITRITE (353.2)	TKN (351.3) @ DL 0.05 mg/l	TOTAL PHOSPHORUS (356.2)					SAMPLE REMARKS	LAB 1 ID	LAB 2 ID
11/96				X		7-BOTM	16337	2	X	X	X	X	X					SEAWATER		
						7-90	338													
						7-60	339													
						7-30	340													
						7-SURF	341													

Sampled By & Title (Please sign and print name) S. Costa	Date/Time 11/96	Relinquished By (Please sign and print name) S. Costa	Date/Time 11/22/96
Received By (Please sign and print name) M. Brown	Date/Time 11/25	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via UPS Fed-Ex Other DHL	Shipping #

HAZWRAP/NESSA: Y N	
EDATA: Y N	
QC LEVEL 1 2 3 OTHER ___	
pH	Ice
Custody Seal	Temp

Batch Remarks: TKN DL of 0.05 mg/l DO NOT RUN TURBIDITY ON THESE SAMPLES

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 5/95 LAB FORM 340

Page 2 of 2

QAL Quality Analytical Laboratories, Inc.

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

Project # 107091.WQ.96

Purchase Order #

Project Name JCO Harbor Monitoring

Company Name CH2M Hill

Project Manager or Contact & Phone # Steve Costa 707-862-0717

Report Copy to:

Requested Completion Date:

Site ID

Sample Disposal: Dispose ☐ Return ☐

☐ **LGN** One Innovation Drive, Suite C, Alachua, FL 32615-9586, (904) 462-3050 FAX (904) 462-1670

☐ **LRD** 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244-4109

☐ **LMG** 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-2440 FAX (334) 271-3428

☐ **LKW** Canviro Analytical Laboratories, Inc., 50 Bathurst, Unit 12, Waterloo, Ontario, Canada N2V 2C5, (519) 747-2575 FAX (519) 747-3806

THIS AREA FOR LAB USE ONLY

Lab #	Page	of
Client Service	Price Source A P Q S	
Acct Code	Test Group	
Project Code	Ack. Gen.	
LIMS Ver	Login	Mult.
COC Review		

ANALYSES REQUESTED

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	QC ID (3 CHAR)	# OF CONTAINERS	Ammonia (350.1)	Nitrate (353.2)	Nitrite (353.2)	TKN 351.3 @ DL 0.05 mg/l	Turbidity (180.1)	Total Phosphorus (365.2)			SAMPLE REMARKS	LAB 1 ID	LAB 2 ID
11/21/96				X		8-BOT.M	16342	2	X	X	X	X	X	X			SEAWATER		
						8-120	343												
						8-90	344												
						8-60	345												
						8-30	346												
						8-SURF	347												
						8A-BOTM	348												
						8A-120	349												
						8A-90	350												
						8A-60	351												
						8A-30	352												

Sampled By & Title (Please sign and print name) S. Costa **Date/Time** 11/21/96

Relinquished By (Please sign and print name) S. Costa **Date/Time** 11/22/96

Received By (Please sign and print name) M. Brown **Date/Time** 11/25/96

Relinquished By (Please sign and print name) **Date/Time**

Received By (Please sign and print name) **Date/Time**

Relinquished By (Please sign and print name) **Date/Time**

Received By (Please sign and print name) **Date/Time**

Shipped Via UPS Fed-Ex Other DHL

Shipping #

HAZWRAP/NESSA: Y N

EDATA: Y N

QC LEVEL 1 2 3 OTHER

pH | Ice

Custody Seal | Temp

Batch Remarks: TKN @ DL of 0.05 mg/l

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 5/95 LAB FORM 340

PAGE 2 of 2

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: ~~WB.96~~ 107091.~~EL.00~~

Purchase Order #:

Project Name: JCO Harbor Monitoring

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] Steve Costa 707-826-0717

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

ANALYSES REQUESTED: Ammonia (350.1); Nitrate (353.2); Nitrite (353.2); TKN @ DL of 0.05 mg/l (351.3); Total Phosphorus (356.2)

SHADED AREA-- FOR LAB USE ONLY: Lab 1 #; Lab 2 #; Quote #; Kit Request #; Project #; No. of Samples; Page of; Login; LIMS Ver

Date	Time	COMP	GRAB	WATER	SOIL	AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	Ammonia (350.1)	Nitrate (353.2)	Nitrite (353.2)	TKN @ DL of 0.05 mg/l (351.3)	Total Phosphorus (356.2)	REMARKS	LAB 1 ID	LAB 2 ID
11/21/96				X			9-BOTM 16354	2	X	X	X	X	X	Seawater		
							9-~~20~~90 355									
							9-60 356									
							9-30 357									
							9-SURF 358									
							9A-BOTM 359									
							9A-90 360									
							9A-60 361									
							9A-30 362									
							9A-SURF 363									

Sampled By & Title (Please sign and print name): S. Costa 11/21/96 — Date/Time

Relinquished By (Please sign and print name): S. Costa 11/22/96 — Date/Time

Received By (Please sign and print name): M. Brown 11/25/96 — Date/Time

Relinquished By (Please sign and print name) — Date/Time

Received By (Please sign and print name) — Date/Time

Relinquished By (Please sign and print name) — Date/Time

QC Level: 1 2 3 Other: ____

COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Received By (Please sign and print name) — Date/Time

Shipped Via: UPS BUS Fed-Ex Hand Other DHL

Shipping #

Work Authorized By (Please sign and print name)

Remarks: TKN @ DL of 0.05 mg/l — No turbidity test

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/94 FORM 349

PAGE 1 of 2

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091.WQ.96

Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #
Mr. [ ]
Ms. [ ]
Dr. [ ]

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

ANALYSES REQUESTED

SHADED AREA-- FOR LAB USE ONLY

Lab 1 #: | Lab 2 #:
Quote #: | Kit Request #:
Project #:
No. of Samples: | Page of
Login: | LIMS Ver

Date	Time	COMP	GRAB	WATER	SOIL	AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	AMMONIA (350.1)	NITRATE (353.1)	NITRITE (353.1)	TKN (351.3) @ DL of 0.05 mg/l	TOTAL PHOSPHORUS (356.2)					REMARKS	LAB 1 ID	LAB 2 ID
11/21/96				X			10-BOTM 364	2	X	X	X	X	X					SEAWATER		
							10-120 365													
							10-90 366													
							10-60 367													
							10-30 368													
							10-SURF 369													
							10A-BOTM 370													
							10A-90 371													
							10A-60 372													
							10A-30 373													
							10A-SURF 374													

Sampled By & Title (Please sign and print name): S. K. Costa 11/21/96 | Date/Time:

Relinquished By (Please sign and print name): S. K. Costa 11/ /96 | Date/Time:

Received By (Please sign and print name): M. Brown | Date/Time: 11/25/96

Relinquished By (Please sign and print name): | Date/Time:

Received By (Please sign and print name): | Date/Time:

Relinquished By (Please sign and print name): | Date/Time:

QC Level: 1 2 3 Other: ____

COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Received By (Please sign and print name): | Date/Time:

Shipped Via: UPS BUS Fed-Ex Hand Other DHL

Shipping #:

Work Authorized By (Please sign and print name):

Remarks: TKN @ DL of 0.05 mg/l — NO TURBIDITY ON THESE

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

PAGE 1 of 2

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091.WQ.96

Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

SHADED AREA– FOR LAB USE ONLY: Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver

ANALYSES REQUESTED: AMMONIA (350.1); NITRATE (353.2); NITRITE (353.2); TKN (351.3) @ DL of 0.05 mg/l; TOTAL PHOSPHORUS 365.2

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	AMMONIA (350.1)	NITRATE (353.2)	NITRITE (353.2)	TKN (351.3) @DL of 0.05 mg/l	TOTAL PHOSPHORUS 365.2	REMARKS	LAB 1 ID	LAB 2 ID
11/20/96				X			11-BOTM	163752	X	X	X	X	X	SEALWATER		
							11-120	376								
							11-90	377								
							11-60	378								
							11-30	379								
							11-SURF	380								
							11A-BOTM	381								
							11A-90	382								
							11A-60	383								
							11A-30	384								
							11A-SURF	385								

Sampled By & Title (Please sign and print name): S. Costa — Date/Time: 11/20/96

Relinquished By (Please sign and print name): S. Costa — Date/Time: 11/22/96

Received By (Please sign and print name): M. Bra[illegible] — Date/Time: 11/25/96

Relinquished By (Please sign and print name) — Date/Time:

Received By (Please sign and print name) — Date/Time:

Relinquished By (Please sign and print name) — Date/Time:

Received By (Please sign and print name) — Date/Time:

QC Level: 1 2 3 Other: ____

COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Shipped Via: UPS BUS Fed-Ex Hand Other DHL

Shipping #:

Work Authorized By (Please sign and print name)

Remarks: TKN @ DL of 0.05 mg/l DO NOT RUN TURBITY ON THESE SAMPLES

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 2/94 FORM 210

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091.WQ.96
Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-7662
Report Copy to:

Requested Completion Date:
Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____
Sample Disposal: Dispose [ ] Return [ ]

OF CONTAINERS

LAB TEST CODES

ANALYSES REQUESTED: AMMONIA (350.1); NITRATE (353.2); NITRITE (353.2); TKN @ DL 0.05 mg/l (351.3); TOTAL PHOSPHORUS (365.2)

SHADED AREA – FOR LAB USE ONLY: Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver

Date	Time	COMP	GRAB	WATER	SOIL	AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	AMMONIA (350.1)	NITRATE (353.2)	NITRITE (353.2)	TKN @ DL 0.05 mg/l (351.3)	TOTAL PHOSPHORUS (365.2)	REMARKS	LAB 1 ID	LAB 2 ID
11/20/96				X			12-BOTM 16386 1 16387	2	X	X	X	X	X	SEAWATER		
							12-30 387									
							12-SURF 388									
							13-BOTM 389									
							13-30 390							*mb 11/25		
							13-SURF 391									

Sampled By & Title (Please sign and print name): [signature] 11/20/96 | Date/Time:
Relinquished By (Please sign and print name): [signature] 11/22/96 | Date/Time:
Received By (Please sign and print name): M. Brown | Date/Time: 11/25/96
Relinquished By (Please sign and print name): | Date/Time:
Received By (Please sign and print name): | Date/Time:
Relinquished By (Please sign and print name): | Date/Time:
Received By (Please sign and print name): | Date/Time:
Shipped Via: UPS BUS Fed-Ex Hand Other DHL | Shipping #:
Work Authorized By (Please sign and print name):
Remarks: TKN @ DL of 0.05 mg/l — NO TURBIDITY ON THESE SAMPLES

QC Level: 1 2 3 Other: ____
COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Instructions and Agreement Provisions on Reverse Side *13-30 - Bottle Labeled 13-15 mb 11/25/96

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client
REV 2/94 FORM 340

PAGE 1 of 2

QAL QUALITY ANALYTICAL LABORATORIES, INC.

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

Project #: 107091.WQ.96

Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name: CH2M HILL

Project Manager or Contact & Phone #: STEVE COSTA 707-826-0717

Report Copy to:

Requested Completion Date:

Site ID:

Sample Disposal: Dispose ☐ Return ☐

☐ LGN — One Innovation Drive, Suite C, Alachua, FL 32615-9586, (904) 462-3050 FAX (904) 462-1670

☐ LRD — 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244-4109

☐ LMG — 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-2440 FAX (334) 271-3428

☐ LKW — Canviro Analytical Laboratories, Inc., 50 Bathurst, Unit 12, Waterloo, Ontario, Canada N2V 2C5, (519) 747-2575 FAX (519) 747-3806

THIS AREA FOR LAB USE ONLY

Lab #	Page	of
Client Service	Price Source A P Q S	
Acct Code	Test Group	
Project Code	Ack. Gen.	
LIMS Ver	Login	Mult.
COC Review		

ANALYSES REQUESTED

Date	Time	COMP	GRAB	WATER	SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	QC ID (3 CHAR)	# OF CONTAINERS	AMMONIA (350.1)	NITRATE (353.2)	NITRITE (353.2)	TKN 351.3 @ DL of 0.05mg/l	TOTAL PHOSPHORUS (365.2)	TURBIDITY (180)				SAMPLE REMARKS	LAB 1 ID	LAB 2 ID
11/21/96				X		14-BOTM	16392	2	X	X	X	X	X	X				SEAWATER		
						14-120	393													
						14-90	394													
						14-30	396 ~~395~~													
						14-SURF	397 ~~396~~													
						15-BOTM	398													
						15-60	399													
						15-30	400													
						15-SURF	401													
						14-60	16395													
						8A-SURF	16353													

Sampled By & Title (Please sign and print name): S. Costa — Date/Time: 11/21/96

Relinquished By (Please sign and print name): S. Costa — Date/Time: 11/22/96

Received By (Please sign and print name): M. Brown — Date/Time: 11/25/96

Relinquished By (Please sign and print name): — Date/Time:

Received By (Please sign and print name): — Date/Time:

Relinquished By (Please sign and print name): — Date/Time:

Received By (Please sign and print name): — Date/Time:

Shipped Via: UPS Fed-Ex Other DHL

Shipping #:

HAZWRAP/NESSA: Y N

EDATA: Y N

QC LEVEL 1 2 3 OTHER

pH — Ice

Custody Seal — Temp

Batch Remarks: TKN DL of 0.05 mg/l

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 5/95 LAB FORM 340

PAGE 1 of 2

QAL QUALITY ANALYTICAL LABORATORIES, INC.

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

Project # 107091.WQ.96

Purchase Order #

Project Name JCO HARBOR MONITORING

Company Name CH2M HILL

Project Manager or Contact & Phone # STEVE COSTA 707-826-0717

Report Copy to:

Requested Completion Date:

Site ID

Sample Disposal: Dispose ☐ Return ☐

☐ LGN One Innovation Drive, Suite C Alachua, FL 32615-9586 (904) 462-3050 FAX (904) 462-1670

☐ LRD 5090 Caterpillar Road Redding, CA 96003-1412 (916) 244-5227 FAX (916) 244-4109

☐ LMG 2567 Fairlane Drive Montgomery, AL 36116-1622 (334) 271-2440 FAX (334) 271-3428

☐ LKW Canviro Analytical Laboratories, Inc. 50 Bathurst, Unit 12 Waterloo, Ontario, Canada N2V 2C5 (519) 747-2575 FAX (519) 747-3806

THIS AREA FOR LAB USE ONLY

Lab #	Page	of
Client Service	Price Source A P Q S	
Acct Code	Test Group	
Project Code	Ack. Gen.	
LIMS Ver	Login	Mult.
COC Review		

ANALYSES REQUESTED

Date	Time	COMP	GRAB	WATER	SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	QC ID (3 CHAR)	# OF CONTAINERS	AMMONIA (350.1)	NITRATE (353.2)	NITRITE (353.2)	TKN @ 0.05 mg/l 351.3	TOTAL PHOSPHORUS (365.2)	TURBIDITY (180.1)				SAMPLE REMARKS	LAB 1 ID	LAB 2 ID
11/21/96				X		16-BOTM	16402	2	X	X	X	X	X	X				SEAWATER		
						16-120	403													
						16-90	404													
						16-60	16405													
						16-30	406													
						16-SURF	407													
						17-BOTM	408													
						17-30	409													
						17-SURF	410													
						18-BOTM	411													
						18-120	412													

Sampled By & Time (Please sign and print name) [signature] Date/Time 11/21/96

Received By (Please sign and print name) M. Bro[signature] Date/Time 11/25/96

Received By (Please sign and print name) Date/Time

Received By (Please sign and print name) Date/Time

Relinquished By (Please sign and print name) [signature] Date/Time 22 Nov 96

Relinquished By (Please sign and print name) Date/Time

Relinquished By (Please sign and print name) Date/Time

Shipped Via UPS Fed-Ex Other DHL

Shipping #

HAZWRAP/NESSA: Y N

EDATA: Y N

QC LEVEL 1 2 3 OTHER

pH | Ice

Custody Seal | Temp

Batch Remarks: TKN DL of 0.05 mg/l

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 5/95 LAB FORM 340

Page 2 of 2

QUALITY ANALYTICAL LABORATORIES, INC.

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

Project #: 107091.EL.W8
Purchase Order #:
Project Name: JCO HARBOR MONITORING
Company Name: CH2M HILL
Project Manager or Contact & Phone #: STEVE COSTA 707-826-7662
Report Copy to:
Requested Completion Date:
Site ID:
Sample Disposal: Dispose ☐ Return ☐

☐ LGN
One Innovation Drive, Suite C
Alachua, FL 32615-9586
(904) 462-3050 FAX (904) 462-1670

☐ LRD
5090 Caterpillar Road
Redding, CA 96003-1412
(916) 244-5227 FAX (916) 244-4109

☐ LMG
2567 Fairlane Drive
Montgomery, AL 36116-1622
(334) 271-2440 FAX (334) 271-3428

☐ LKW
Canviro Analytical Laboratories, Inc.
50 Bathurst, Unit 12
Waterloo, Ontario, Canada N2V 2C5
(519) 747-2575 FAX (519) 747-3806

THIS AREA FOR LAB USE ONLY

Lab #	Page / of
Client Service	Price Source A P Q S
Acct Code	Test Group
Project Code	Ack. Gen.
LIMS Ver	Login / Mult.
COC Review	

ANALYSES REQUESTED

Sampling Date	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	QC ID (3 CHAR)	# OF CONTAINERS	AMMONIA (350.1)	NITRATE (353.2)	NITRITE (351.2)	TKN @ DL 0.05 mg/l 351.3	TOTAL PHOSPHORUS (356.2)	TURBIDITY (180.1)	SAMPLE REMARKS	LAB 1 ID	LAB 2 ID
11/21/96				X		18-90	16413	2	X	X	X	X	X	X	SEAWATER		
						18-60	414										
						18-30	415										
						18-SURF	416										

Sampled By & Title (Please sign and print name): S. Costa Date/Time: 20/22 Nov 96
Relinquished By (Please sign and print name): S. Costa Date/Time: 22 Nov 96
Received By (Please sign and print name): M. Brown Date/Time: 11/25/96
Relinquished By (Please sign and print name): Date/Time:
Received By (Please sign and print name): Date/Time:
Relinquished By (Please sign and print name): Date/Time:
Received By (Please sign and print name): Date/Time:
Shipped Via: UPS Fed-Ex Other DHL
Shipping #:

HAZWRAP/NESSA: Y N
EDATA: Y N
QC LEVEL 1 2 3 OTHER
pH
Ice
Custody Seal
Temp

Batch Remarks: TKN DL of 0.05 mg/l

Instructions and Agreement Provisions on Reverse Side

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REV 5/95 LAB FORM 340

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091.WQ.96
Purchase Order #:

Project Name: HARBOR WATER QUALITY

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

ANALYSES REQUESTED: CHLOROPHYLL-A

SHADED AREA-- FOR LAB USE ONLY: Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	CHLOROPHYLL-A	REMARKS	LAB 1 ID	LAB 2 ID
11/20-23/96			X	X			6-BOTM	1	X			
11/20-23/96			X	X			6-120	1	X			
11/20-23/96			X	X			6-90	1	X			
11/20-23/96			X	X			6-60	1	X			
11/20-23/96			X	X			6-30	1	X			
11/20-23/96			X	X			6-SURF	1	X			
11/20-23/96			X	X			6A-BOTM	1	X			
11/20-23/96			X	X			6A-60	1	X			
11/20-23/96			X	X			6A-30	1	X			
11/20-23/96			X	X			6A-SURF	1	X			
11/20-23/96			X	X			7-BOTM	1	X			

Sampled By & Title (Please sign and print name) — Date/Time

Relinquished By (Please sign and print name): S. Costa — Date/Time: 11/25/96

Received By (Please sign and print name): D. Wilson D. Wilson — Date/Time: 11/25/96 1200

Relinquished By (Please sign and print name): D. Wilson — Date/Time: 11/27/96 1020

Received By (Please sign and print name): M Brown — Date/Time: 11/27

Relinquished By (Please sign and print name) — Date/Time

Received By (Please sign and print name) — Date/Time

Shipped Via: UPS BUS Fed-Ex Hand Other HAND — Shipping #

Work Authorized By (Please sign and print name)

Remarks

QC Level: 1 2 3 Other: ____

COC Rec	ICE
Ana Req	TEMP
Cust Seal	Ph

Instructions and Agreement Provisions on Reverse Side

PAGE 2 of 10

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091.WQ.96

Purchase Order #:

Project Name: HARBOR WATER QUALITY

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

ANALYSES REQUESTED: CHLOROPHYLL-a

SHADED AREA-- FOR LAB USE ONLY

Lab 1 #: | Lab 2 #:

Quote #: | Kit Request #:

Project #:

No. of Samples: | Page of

Login: | LIMS Ver

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	CHLOROPHYLL-a	REMARKS	LAB 1 ID	LAB 2 ID
11/20-23/96			X	X			7-90	1	X			
							7-60					
							7-30					
							7-SURF					
							8-BOTM					
							8-120					
							8-90					
							8-60					
							8-30					
							8-SURF					
							8A-BOTM					

Sampled By & Title (Please sign and print name) | Date/Time

Relinquished By (Please sign and print name): S. Costa | Date/Time: 11/25/96

Received By (Please sign and print name): D. Wilson D. Wilson | Date/Time: 11/25/96 1200

Relinquished By (Please sign and print name): [signature] | Date/Time: 11/27/96 1020

Received By (Please sign and print name): M. Brown | Date/Time: 11/27

Relinquished By (Please sign and print name) | Date/Time

Received By (Please sign and print name) | Date/Time

Shipped Via: UPS BUS Fed-Ex Hand Other HAND | Shipping #

Work Authorized By (Please sign and print name) | Remarks

QC Level: 1 2 3 Other: ____

COC Rec	ICE
Ana Req	TEMP
Cust Seal	Ph

Instructions and Agreement Provisions on Reverse Side

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REV 3 94 FORM 340

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CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091.WQ.96

Purchase Order #:

Project Name: HARBOR WATER QUALITY

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

ANALYSES REQUESTED: Chlorophyll-a

SHADED AREA-- FOR LAB USE ONLY

Lab 1 #: | Lab 2 #:

Quote #: | Kit Request #:

Project #:

No. of Samples: | Page of

Login: | LIMS Ver

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	Chlorophyll-a	REMARKS	LAB 1 ID	LAB 2 ID
11/20-23/96			X	X			8A-120	1	X			
↓			↓	↓			8A-90	↓	↓			
↓			↓	↓			8A-60	↓	↓			
↓			↓	↓			8A-30	↓	↓			
↓			↓	↓			8A-SURF	↓	↓			
↓			↓	↓			9-BOTM	↓	↓			
↓			↓	↓			9-90	↓	↓			
↓			↓	↓			9-60	↓	↓			
↓			↓	↓			9-30	↓	↓			
↓			↓	↓			9-SURF	↓	↓			
↓			↓	↓			9A-BOTM	↓	↓			

Sampled By & Title (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name) S. Costa	11/25/96	Date/Time	QC Level: 1 2 3 Other: ____
Received By (Please sign and print name) N.P. Walton	Date/Time 11/25/96 1200	Relinquished By (Please sign and print name) N.P. Walton	11/27/96	Date/Time 1020	COC Rec / ICE; Ana Req / TEMP
Received By (Please sign and print name) M. Brown	Date/Time 11/27	Relinquished By (Please sign and print name)		Date/Time	Cust Seal / Ph
Received By (Please sign and print name)	Date/Time	Shipped Via UPS BUS Fed-Ex Hand Other HAND		Shipping #	
Work Authorized By (Please sign and print name)	Remarks				

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/94 FORM 340

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091.WQ.96
Purchase Order #:

Project Name: HARBOR WATER QUALITY

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA ~~707~~ 826-0717
Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

ANALYSES REQUESTED: CHLOROPHYLL-a

SHADED AREA-- FOR LAB USE ONLY

Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver

Sampling Date	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	CHLOROPHYLL-a	REMARKS	LAB 1 ID	LAB 2 ID
11/20-23/96			X	X			9A-90	1	X			
							9A-60					
							9A-30					
							9A-SURF					
							10-BOTM					
							10-120					
							10-90					
							10-60					
							10-30					
							10-SURF					
							10A-BOTM					

Sampled By & Title (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name) S. Costa	Date/Time 11/25/96
Received By (Please sign and print name) NP Wilson	Date/Time 11/25/96 1200	Relinquished By (Please sign and print name) NP Wilson	Date/Time 11/27/96 10:20
Received By (Please sign and print name) M. Borow	Date/Time 11/27	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via UPS BUS Fed-Ex Hand Other HAND	Shipping #
Work Authorized By (Please sign and print name)	Remarks		

QC Level: 1 2 3 Other: ____

COC Rec	ICE
Ana Req	TEMP
Cust Seal	Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client
REV 3/94 FORM 340

PAGE 5 of 10

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091.WQ.96
Purchase Order #:

Project Name: HARBOR WATER QUALITY

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] Steve Costa 707-826-0717
Report Copy to:

Requested Completion Date:
Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____
Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

ANALYSES REQUESTED: CHLOROPHYLL-a

SHADED AREA-- FOR LAB USE ONLY
Lab 1 #: | Lab 2 #:
Quote #: | Kit Request #:
Project #:
No. of Samples: | Page of
Login: | LIMS Ver

Date	Time	COMP	GRAB	WATER	SOIL	AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	CHLOROPHYLL-a	REMARKS	LAB 1 ID	LAB 2 ID
11/20-23/96			X	X			10A-90	1	X			
							10A-60					
							10A-30					
							10A-SURF					
							11A-BOTM					
							11A-90					
							11A-60					
							11A-30					
							11A-SURF					
							12~~A~~-BOTM					
							12-30					

Sampled By & Title (Please sign and print name) | Date/Time
Received By (Please sign and print name) M. Wilson | Date/Time 11/25/96 1200
Received By (Please sign and print name) M. Polo | Date/Time 11/27
Received By (Please sign and print name) | Date/Time
Work Authorized By (Please sign and print name) | Remarks

Relinquished By (Please sign and print name) S. Costa | Date/Time 11/25/96
Relinquished By (Please sign and print name) M. Wilson | Date/Time 11/27/96 1020
Relinquished By (Please sign and print name) | Date/Time

Shipped Via: UPS BUS Fed-Ex Hand Other HAND
Shipping #

QC Level: 1 2 3 Other: ____
COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client
REV 3/94 FORM 340

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091.WQ.96
Purchase Order #:
Project Name: HARBOR WATER QUALITY
Company Name/CH2M HILL Office: CH2M HILL
Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717
Report Copy to:
Requested Completion Date:
Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____
Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

ANALYSES REQUESTED

SHADED AREA-- FOR LAB USE ONLY
Lab 1 # | Lab 2 #
Quote # | Kit Request #
Project #
No. of Samples | Page of
Login | LIMS Ver

Sampling Date	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	CHLOROPHYLL-a	REMARKS	LAB 1 ID	LAB 2 ID
11/20-23/96			X	X			12-SURF	1	X			
↓			↓	↓			14-BOTM	↓	↓			
↓			↓	↓			14-120	↓	↓			
↓			↓	↓			14-90	↓	↓			
↓			↓	↓			14-60	↓	↓			
↓			↓	↓			14-30	↓	↓			
↓			↓	↓			14-SURF	↓	↓			
↓			↓	↓			17-BOTM	↓	↓			
↓			↓	↓			17-30	↓	↓			
↓			↓	↓			17-SURF	↓	↓			
↓			↓	↓			5-BOTM	↓	↓			

Sampled By & Title (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
		S L Costa	11/25/96
Received By (Please sign and print name): M.P. Wilson	Date/Time: 11/25/96 1200	Relinquished By (Please sign and print name): M.P. Wilson	11/27/96 Date/Time: 1020
Received By (Please sign and print name): M. Brown	Date/Time: 11/27	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via: UPS BUS Fed-Ex Hand Other HAND	Shipping #
Work Authorized By (Please sign and print name)	Remarks		

QC Level: 1 2 3 Other: ____
COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client
REV 3/94 FORM 340

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091.WQ.96
Purchase Order #:

Project Name: HARBOR WATER QUALITY

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA ☐ NPDES ☒ RCRA ☐ OTHER ____

Sample Disposal: Dispose ☐ Return ☐

LAB TEST CODES

ANALYSES REQUESTED: CHLOROPHYLL-a

SHADED AREA-- FOR LAB USE ONLY

Lab 1 # | Lab 2 #
Quote # | Kit Request #
Project #
No. of Samples | Page of
Login | LIMS Ver

Sampling Date	Sampling Time	COMP	GRAB	WATER	SOIL	AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	CHLOROPHYLL-a	REMARKS	LAB 1 ID	LAB 2 ID
11/20-23/96			X	X			5-120	1	X			
							5-90					
							5-60					
							5-30					
							5-SURF					
							5A-BOTM					
							5A-120					
							5A-90					
							5A-60					
							5A-30					
							5A-SURF					

Sampled By & Title (Please sign and print name) | Date/Time

Relinquished By (Please sign and print name) [signature] | 11/25/96 | Date/Time

Received By (Please sign and print name) M. Wilson | Date/Time 11/25/96 1200

Relinquished By (Please sign and print name) M. Wilson | 11/27/96 | Date/Time 10:20

Received By (Please sign and print name) M. Brown | Date/Time 11/27

Relinquished By (Please sign and print name) | Date/Time

QC Level: 1 2 3 Other: ____

COC Rec	ICE
Ana Req	TEMP
Cust Seal	Ph

Received By (Please sign and print name) | Date/Time

Shipped Via: UPS BUS Fed-Ex Hand Other: HAND

Shipping #

Work Authorized By (Please sign and print name)

Remarks

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client
REV 3/94 FORM 340

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091.WQ.96
Purchase Order #:

Project Name: HARBOR WATER QUALITY

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA ☐ NPDES ☒ RCRA ☐ OTHER ____

Sample Disposal: Dispose ☐ Return ☐

LAB TEST CODES

ANALYSES REQUESTED: CHLOROPHYLL A

SHADED AREA-- FOR LAB USE ONLY

Lab 1 #	Lab 2 #
Quote #	Kit Request #
Project #	
No. of Samples	Page of
Login	LIMS Ver

Sampling Date	Time	COMP	GRAB	WATER	SOIL	AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	CHLOROPHYLL A	REMARKS	LAB 1 ID	LAB 2 ID
11/20-23/96			X	X			11-BOTM	1	X			
							11-120					
							11-90					
							11-60					
							11-30					
							11-SURF					
							13-BOTM					
							13-30					
							13-SURF					
							15-BOTM					
							15-60					

Sampled By & Title (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
		S. Costa	11/25/96
Received By (Please sign and print name): M. Wilson	11/25/96 1200	Relinquished By (Please sign and print name): M. Wilson	11/27/96 1020
Received By (Please sign and print name): M. Brown	11/27	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via: UPS BUS Fed-Ex Hand Other HAND	Shipping #
Work Authorized By (Please sign and print name)	Remarks		

QC Level: 1 2 3 Other: ____

COC Rec	ICE
Ana Req	TEMP
Cust Seal	Ph

Instructions and Agreement Provisions on Reverse Side

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REV 3/94 FORM 340

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091.WQ.96
Purchase Order #:
Project Name: HARBOR WATER QUALITY
Company Name/CH2M HILL Office: CH2M HILL
Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717
Report Copy to:
Requested Completion Date:
Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____
Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

ANALYSES REQUESTED: CHLOROPHYLL-a

SHADED AREA-- FOR LAB USE ONLY
Lab 1 #: | Lab 2 #:
Quote #: | Kit Request #:
Project #:
No. of Samples: | Page of
Login: | LIMS Ver

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	CHLOROPHYLL-a	REMARKS	LAB 1 ID	LAB 2 ID
11/20-23/96			X	X			15-30	1	X			
							15-SURF					
							16-BOTM					
							16-120					
							16-90					
							16-60					
							16-30					
							16-SURF					
							18-BOTM					
							18-120					
							18-90					

Sampled By & Title (Please sign and print name) | Date/Time
Relinquished By (Please sign and print name): S. Costa | 11/25/96 | Date/Time
Received By (Please sign and print name): M. Wilson | Date/Time: 11/25/96 1200
Relinquished By (Please sign and print name): M. Wilson | 11/27/96 | Date/Time: 1020
Received By (Please sign and print name): M. Brown | Date/Time: 11/27
Relinquished By (Please sign and print name) | Date/Time
Received By (Please sign and print name) | Date/Time
Shipped Via: UPS BUS Fed-Ex Hand Other HAND | Shipping #
Work Authorized By (Please sign and print name) | Remarks

QC Level: 1 2 3 Other: ____
COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client
REV 3/94 FORM 340

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091.WQ.96
Purchase Order #:

Project Name: HARBOR WATER QUALITY

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717
Report Copy to:

Requested Completion Date:
Sampling Requirements: SDWA ☐ NPDES ☒ RCRA ☐ OTHER ____
Sample Disposal: Dispose ☐ Return ☐

LAB TEST CODES

ANALYSES REQUESTED: CHLOROPHYLL-a

SHADED AREA-- FOR LAB USE ONLY
Lab 1 #: | Lab 2 #:
Quote #: | Kit Request #:
Project #:
No. of Samples: | Page of
Login: | LIMS Ver

Sampling Date	Time	COMP	GRAB	WATER	SOIL	AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	CHLOROPHYLL-a	REMARKS	LAB 1 ID	LAB 2 ID
11/20-23/96			X	X			18-60	1	X			
							18-30					
							18-SURF					

NOTE: 102 SAMPLES TOTAL COUNT

Sampled By & Title (Please sign and print name) | Date/Time | Relinquished By (Please sign and print name) S. Costa | 11/25/96 | Date/Time

Received By (Please sign and print name) W. Walsh | Date/Time 11/25/96 1200 | Relinquished By (Please sign and print name) W. Walsh | 11/27/96 | Date/Time 1020

Received By (Please sign and print name) M. Brown | Date/Time 11/27 | Relinquished By (Please sign and print name) | Date/Time

Received By (Please sign and print name) | Date/Time | Shipped Via: UPS BUS Fed-Ex Hand Other HAND | Shipping #

Work Authorized By (Please sign and print name) | Remarks

QC Level: 1 2 3 Other: ____
COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

QAL QUALITY ANALYTICAL LABORATORIES, INC.

Q 898

16.5, 14.5°C

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

Project # 107091.WQ.96

Purchase Order #

Project Name JCO HARBOR W/Q STUDY

Company Name CH2M HILL

Project Manager or Contact & Phone # STEVE COSTA 707-826-0717

Report Copy to: David Wilson (Seattle)

Requested Completion Date:

Site ID

Sample Disposal: ☐ Dispose ☐ Return

☐ **LGN** One Innovation Drive, Suite C, Alachua, FL 32615-9586, (904) 462-3050 FAX (904) 462-1670

☐ **LRD** 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244-4109

☐ **LMG** 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-2440 FAX (334) 271-3428

☐ **LKW** Canviro Analytical Laboratories, Inc., 50 Bathurst, Unit 12, Waterloo, Ontario, Canada N2V 2C5, (519) 747-2575 FAX (519) 747-3806

THIS AREA FOR LAB USE ONLY

Lab #	Page	of
Client Service	Price Source A P Q S	
Acct Code	Test Group	
Project Code	Ack. Gen.	
LIMS Ver	Login	Mult.
COC Review		

ANALYSES REQUESTED: COPPER 200 Series; ZINC 200 Series

Per your quotation for Cu @ <2 ug/l, for Zn @ ~~20~~ ug/l

Date	Time	COMP	GRAB	WATER	SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	QC ID (3 CHAR)	# OF CONTAINERS	COPPER 200 Series	ZINC 200 Series	SAMPLE REMARKS	LAB 1 ID	LAB 2 ID
11/21				X		15-30		2	X	X	SEE BELOW		
↓				↓		15-60		↓	↓	↓	↓		
↓				↓		15-BOTM		↓	↓	↓	↓		
↓				↓		16-30		↓	↓	↓	↓		
↓				↓		16-120		↓	↓	↓	(SAMPLE 16-120)		
↓				↓		16-BOTM		↓	↓	↓	↓		
↓				↓		18-30		↓	↓	↓	↓		
↓				↓		18-120		↓	↓	↓	↓		
↓				↓		18-BOTM		↓	↓	↓	↓		

↳ 1440 Union St. Arcata, CA 95521 D.O.# 1125 ...

Sampled By & Title (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
S. K. Costa	11/96	S. K. Costa	11/22/96
Received By (Please sign and print name) JASON SARZA	11.25.96 1600	**Relinquished By** (Please sign and print name)	
Received By (Please sign and print name)		**Relinquished By** (Please sign and print name)	
Received By (Please sign and print name)		**Shipped Via** UPS Fed-Ex Other DHL	**Shipping #**

HAZWRAP/NESSA: Y N

EDATA: Y N

QC LEVEL 1 2 3 OTHER ______

pH | Ice

Custody Seal | Temp

Batch Remarks: SEAWATER — HOLD SECOND CONTAINER FOR POSSIBLE ADDITIONAL TESTING

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 5/95 LAB FORM 340

Q018

QAL ...ITY ANALYTICAL L...ORATORIES, INC.

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

Project # 107091.WQ.96

Purchase Order #

Project Name JCO HARBOR W/Q STUDY

Company Name CH2M HILL

Project Manager or Contact & Phone # STEVE COSTA 707-826-0717

Report Copy to:

Requested Completion Date:

Site ID

Sample Disposal: Dispose ☐ Return ☐

☐ **LGN** One Innovation Drive, Suite C, Alachua, FL 32615-9586, (904) 462-3050 FAX (904) 462-1670

☐ **LRD** 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244-4109

☐ **LMG** 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-2440 FAX (334) 271-3428

☐ **LKW** Canviro Analytical Laboratories, Inc., 50 Bathurst, Unit 12, Waterloo, Ontario, Canada N2V 2C5, (519) 747-2575 FAX (519) 747-3806

THIS AREA FOR LAB USE ONLY

Lab #	Page	of
Client Service	Price Source A P Q S	
Acct Code	Test Group	
Project Code	Ack. Gen.	
LIMS Ver	Login	Mult.
COC Review		

ANALYSES REQUESTED

PER YOUR QUOTATION FOR Cu @ <2ug/l FOR Zn @ ~~20~~ ug/l

Sampling 1996 Date	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	QC ID (3 CHAR)	# OF CONTAINERS	COPPER	ZINC	SAMPLE REMARKS	LAB 1 ID	LAB 2 ID
11/21				X		5-30		2	X	X	SEE BELOW		
						5-120							
						5-BOTM							
						5A-30							
						5A-120							
						5A-BOTM							
11/20						11-30							
						11-120							
						11-BOTM							
						13-SURF							
						13-BOTM							

Sampled By & Title (Please sign and print name) [signature]	Date/Time 11/96	Relinquished By (Please sign and print name) [signature]	Date/Time 11/22/96
Received By (Please sign and print name) [signature] JASON SOUZA	Date/Time 11-25-96 1600	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via UPS Fed-Ex Other DHL	Shipping #

HAZWRAP/NESSA: Y N

EDATA: Y N

QC LEVEL 1 2 3 OTHER

pH · Ice

Custody Seal · Temp

Batch Remarks: SEAWATER; HOLD SECOND CONTAINER FOR POSSIBLE ADDITIONAL TESTING

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 5 95 LAB FORM 340

Appendix V

Laboratory Report for Nutrients and Biological Parameters

AMTEST

AmTest Inc
Professional Analytical Services
14603 N.E. 87th St
Redmond WA 98052
Fax 206 883 3495
Tel. 206 885 1664

ANALYSIS REPORT

CH2M Hill
PO Box 91500
Bellevue, WA 98009-2050
Attention: Steve Costa

Date Received: 11/25/96
Date Reported: 12/11/96

Project Name: JCO Harbor Mont.
Project #: 107091.WQ.96
Date Sampled: 11/21/96

Water Samples

PARAMETER	UNITS	RESULT
96-A016315		
Client ID: 5-BOTTOM		
Chlorophyll a	mg/m3	0.12
Pheophytin	mg/m3	0.12
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.028
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.009
Total Phosphorus	mg/l	0.013
96-A016316		
Client ID: 5-120		
Chlorophyll a	mg/m3	0.12
Pheophytin	mg/m3	0.13
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.092
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	0.011
96-A016317		
Client ID: 5-90		
Chlorophyll a	mg/m3	0.59
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.066
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	< 0.005
96-A016318		
Client ID: 5-60		
Chlorophyll a	mg/m3	0.48
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.049
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.014

AMTEST

ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96
Date Reported: 12/11/96

Attention: Steve Costa

Water Samples

PARAMETER	UNITS	RESULT
96-A016319		
Client ID: 5-30		
Chlorophyll a	mg/m3	0.22
Pheophytin	mg/m3	0.09
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.009
96-A016320		
Client ID: 5-SURF		
Chlorophyll a	mg/m3	0.25
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.028
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.009
96-A016321		
Client ID: 5A-BOTTOM		
Chlorophyll a	mg/m3	0.36
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.009
Total Phosphorus	mg/l	0.010
96-A016322		
Client ID: 5A-120		
Chlorophyll a	mg/m3	0.47
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.009

gdc

COASTAL ENVIRONMENTAL ANALYSTS

14 December 1997

Mr. Carl Goldstein
American Samoa Program Manager
Office of Pacific Islands
and Native American Programs
U.S. Environmental Protection Agency
75 Hawthorne Street
San Francisco, CA 94105

Ms Sheila Wiegman
American Samoa
Environmental Protection Agency
American Samoa Government
Pago Pago, American Samoa 96799

Re: Harbor Wat [illegible] ber 1997 Sampling)
StarKist San [illegible]
VCS Samoa I [illegible] 0027)

Dear Carl and Sheil

Enclosed are two co [illegible] r Water Quality Monitoring conducted in August/September [illegible] water quality sampling under the current permit. At this tir [illegible]

No As, Hg, or PCB monitoring

Sincerely,

Steve Costa

enclosure 1

cc: Norman Wei/StarKist Foods (w/enclosure)
Jim Cox/Van Camp Seafood (w/enclosure)
Barry Mills/StarKist Samoa (w/enclosure)
Herman Gebauer/VCS Samoa Packing (w/enclosure)
David Wilson/CH2M Hill/SEA (w/enclosure)
Karin Noack/CH2M Hill/SFO (w/enclosure)

P.O. BOX 1125 • ARCATA, CA • 95518
PHONE: 707-826-0717 or 7662 • FAX: 707-822-0567
EMAIL: GLATZELDACOSTA@SPRINTMAIL.COM

gdc

COASTAL ENVIRONMENTAL ANALYSTS

14 December 1997

Mr. Carl Goldstein
American Samoa Program Manager
Office of Pacific Islands
and Native American Programs
U.S. Environmental Protection Agency
75 Hawthorne Street
San Francisco, CA 94105

Ms Sheila Wiegman
American Samoa
Environmental Protection Agency
American Samoa Government
Pago Pago, American Samoa 96799

Re: Harbor Water Quality Monitoring (September 1997 Sampling)
StarKist Samoa (NPDES Permit AS0000019)
VCS Samoa Packing (NPDES Permit AS0000027)

Dear Carl and Sheila:

Enclosed are two copies of the reports for the for the Harbor Water Quality Monitoring conducted in August/September 1997. This is the final scheduled harbor water quality sampling under the current permit. At this time we have no additional tests scheduled.

Sincerely,

Steve Costa

enclosure 1

cc: Norman Wei/StarKist Foods (w/enclosure)
Jim Cox/Van Camp Seafood (w/enclosure)
Barry Mills/StarKist Samoa (w/enclosure)
Herman Gebauer/VCS Samoa Packing (w/enclosure)
David Wilson/CH2M Hill/SEA (w/enclosure)
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Receiving Water Quality Monitoring Report
Pago Pago Harbor, American Samoa
September 1997 Sampling

Prepared for

StarKist Samoa
NPDES Permit AS0000019
and
VCS Samoa Packing
NPDES Permit AS0000027

Submitted to

U.S. Environmental Protection Agency
and
American Samoa Environmental Protection Agency

Prepared by

CH2M HILL
and
gdc

8 December 1997

Receiving Water Quality Monitoring Report

Pago Pago Harbor, American Samoa
September 1997 Sampling

Prepared for

StarKist Samoa

NPDES Permit AS0000019

and

VCS Samoa Packing

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Prepared by

CH2M HILL

and

gdc

8 December 1997

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1. INTRODUCTION

This report describes the fourth semi-annual Pago Pago Harbor water quality monitoring field campaign done under revised NPDES permit condition "E" for VCS Samoa Packing and StarKist Samoa. The letter from the U.S. Environmental Protection Agency implementing the changes in the permits, and the revised permit condition are included as Appendix I. The revisions apply to both permits for discharge through the Joint Cannery Outfall (JCO): VCS Samoa Packing holds NPDES permit AS0000027and StarKist Samoa holds NPDES permit AS0000019. The overall purpose of this study and the purpose of this report, a description of the study site, a brief background of the water quality monitoring work done in the Harbor, and the scope and organization of this report are described below in this section of the report. Following sections of the report describe the field data collection, the laboratory results of samples collected, and conclusions and recommendations based on the results.

1.1 PURPOSE

The purpose of the Receiving Water Quality Monitoring Program is, as described in the permit, "to determine compliance with water quality standards". To achieve this the program must, as described in the permit, "document water quality at the outfall, at areas near the zone of initial dilution (ZID) and zone of mixing (ZOM) boundaries, at areas beyond these zones where discharge impacts might reasonably be expected, and at reference/control areas". The purpose of this report is to document the fourth set of data, collected during September 1997, and to evaluate these data in terms of compliance with water quality standards.

1.2 STUDY LOCATION

Water quality measurements and samples were obtained throughout Pago Pago Harbor, Tutuila Island, American Samoa. The island is located approximately 2300 miles southwest of Hawaii, 1600 miles northeast of New Zealand, and 1000 miles south of the equator at latitude 14° 17′ S and longitude 171° 40′ W (approximately). The general location is shown in Figure 1-1. The harbor is approximately 15,000 feet long with the entrance to the south. The outer harbor trends north-south with widths varying between 3000 and 6000 feet. The inner harbor trends east-west with the head of the harbor to the west and ranges from less than 1000 to about 3000 feet wide. Figure 1-2 shows the general harbor morphology. Maximum depths along a cross section range from less than 60 to over 200 feet, with fringing reefs periodically exposed at low tide throughout the middle and outer harbor areas.

The climate is tropical with about 200 inches of rainfall annually, air temperatures typically between 70 and 90°F, and high humidity. Orographic effects create higher rainfall in the vicinity of the harbor than at other locations on the Island. The watershed of the harbor is small relative to the harbor size with about 4.9 mi^2 of drainage area compared to about 2.4 mi^2

of water surface area. Therefore, the harbor is typically a marine dominated system with depressed salinities normally found only very close to stream mouths.

Tides are semi-diurnal with a range of about 2.5 feet and little diurnal inequality. The circulation in the Harbor is mainly wind driven with both tidal and freshwater influences generally very small except at localized sites. Winds are usually from the east and southeast and are from this direction most of the time during the tradewind season, which is typically April/May through October/November. During November/December through March/April the east to southeast winds still predominate but a northwest to northeast component becomes more prevalent (the non-tradewind season).

The tuna canneries discharge through the JCO which terminates in a mulitport diffuser at a depth of approximately 176 feet in the outer harbor (see Figure 1-3). Typical flows through the outfall are approximately 2 mgd. The discharge is in the center of a mixing zone for total nitrogen (TN) and total phosphorous (TP) as shown in Figure 1-3. A small mixing zone for ammonia has also been established and is defined within 12 meters of the diffuser discharge ports.

1.3 BACKGROUND

Prior to the implementation of high strength waste segregation and outfall relocation, the canneries discharged treated wastewater into the inner harbor though two outfalls. These outfalls terminated in about 80 feet of water in open-ended pipes without diffusers. In August 1990 both canneries started high strength waste segregation and offshore ocean disposal of the high strength waste streams (those process streams highest in nitrogen, phosphorous, suspended solids, and BOD). In February 1992 both canneries began discharging treated wastewater (without the high strength waste component) through a single outfall, relocated approximately 8400 feet seaward from the previous discharge point, at about the 180-foot contour, in the outer harbor. The new outfall terminates in a diffuser consisting of four active and two inactive (backup) ports.

The current NPDES permits for both canneries, which became effective in October 1992, required monthly monitoring of water quality parameters, with emphasis on nutrients, at established monitoring stations throughout the harbor. This monitoring had been carried out by the American Samoa Environmental Protection Agency (ASEPA). In November 1995, USEPA revised the permit condition for reasons given in the notification of revision (Appendix I). The revised water quality monitoring (Appendix I) is similar to, and extends the usefulness of, the original monitoring condition. The major changes in the permit condition include:

- The frequency of sampling was reduced from monthly to semi-annually
- The number of sampling locations was increased from 17 to 20

- Continuous vertical profiles of temperature, salinity, dissolved oxygen, pH, and turbidity, rather than grab samples, are now required
- The number of sampling depths was changed from three to a maximum of six at 30-foot increments plus near bottom (with a minimum of three samples in shallow water)
- Suspended solids was removed from the list of analytes
- Sampling for zinc and copper was added for seven locations at specified depths

The first of the monitoring episodes required by the revised permit was conducted in March 1996. The second was conducted in November 1996 and the third in March1997. This report describes the fourth and final monitoring episode required by the revised permit, which was conducted in September 1997. The sampling episodes are timed to include both the tradewind and non-tradewind oceanographic seasons.

1.4 SCOPE AND ORGANIZATION OF REPORT

The following sections of this report describe the field data collection (Section 2), summarize the data acquired (Section 3), and provide conclusions and recommendations, if any, based on the field data collection and results (Section 4). Section 2 includes specific information on sample station locations and times, field methods, and describes any deviations from the intended study plan. Section 3 presents summaries of field measurements and laboratory results with detailed information referenced to appendices when appropriate. Section 4 includes an evaluation of compliance with American Samoa Water Quality Standards (ASWQS) based on the data collected, and presents recommendations for changes in methodology, sampling strategies, or other requirements as appropriate. References are provided (Section 5) and appendices are included describing the specifics of the permit condition, the study and analysis plan and the revised standard operating procedures (SAP/SOP), and detailed data supplements for field measurements and laboratory analyses.

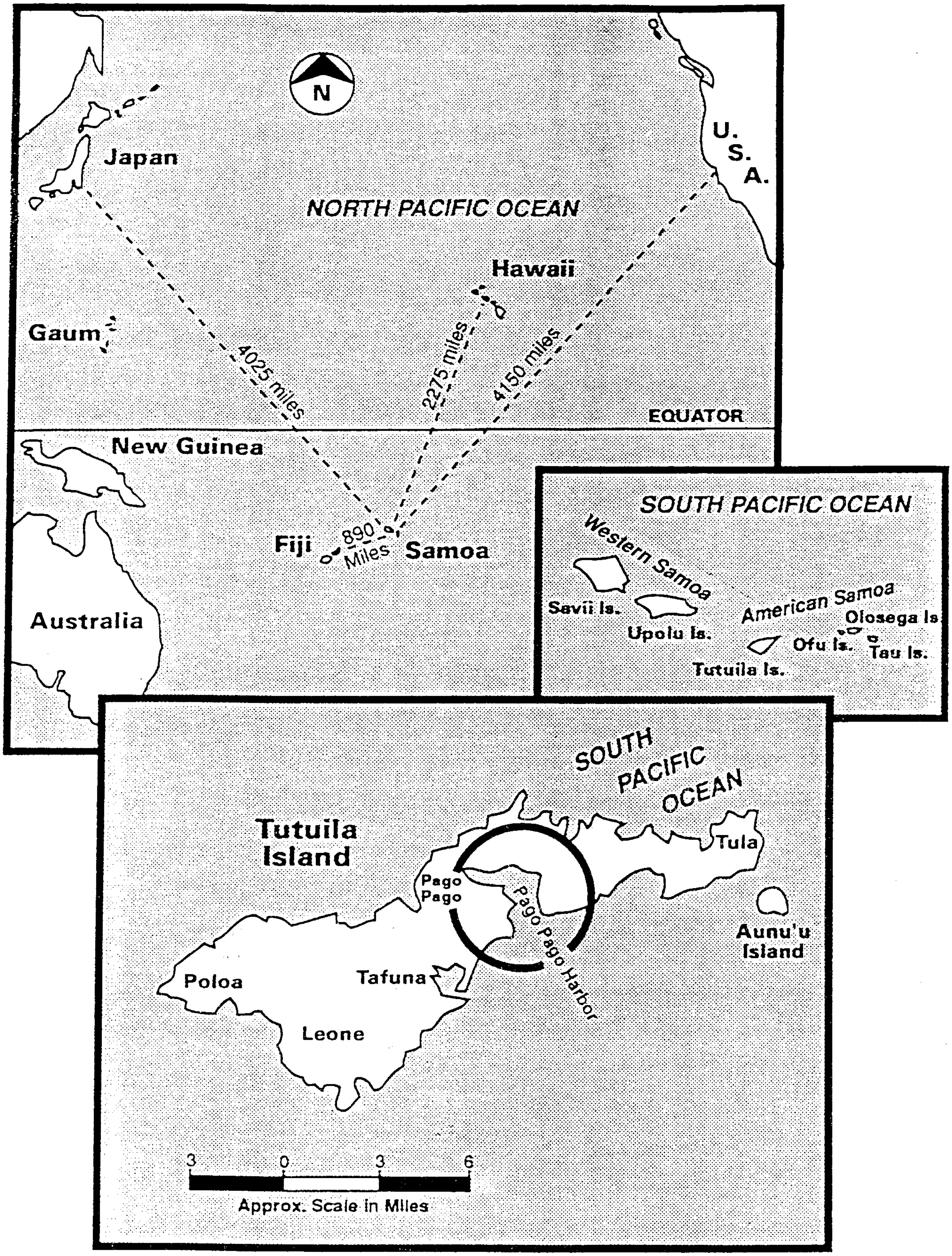

Figure 1-1
Overview of Study Site

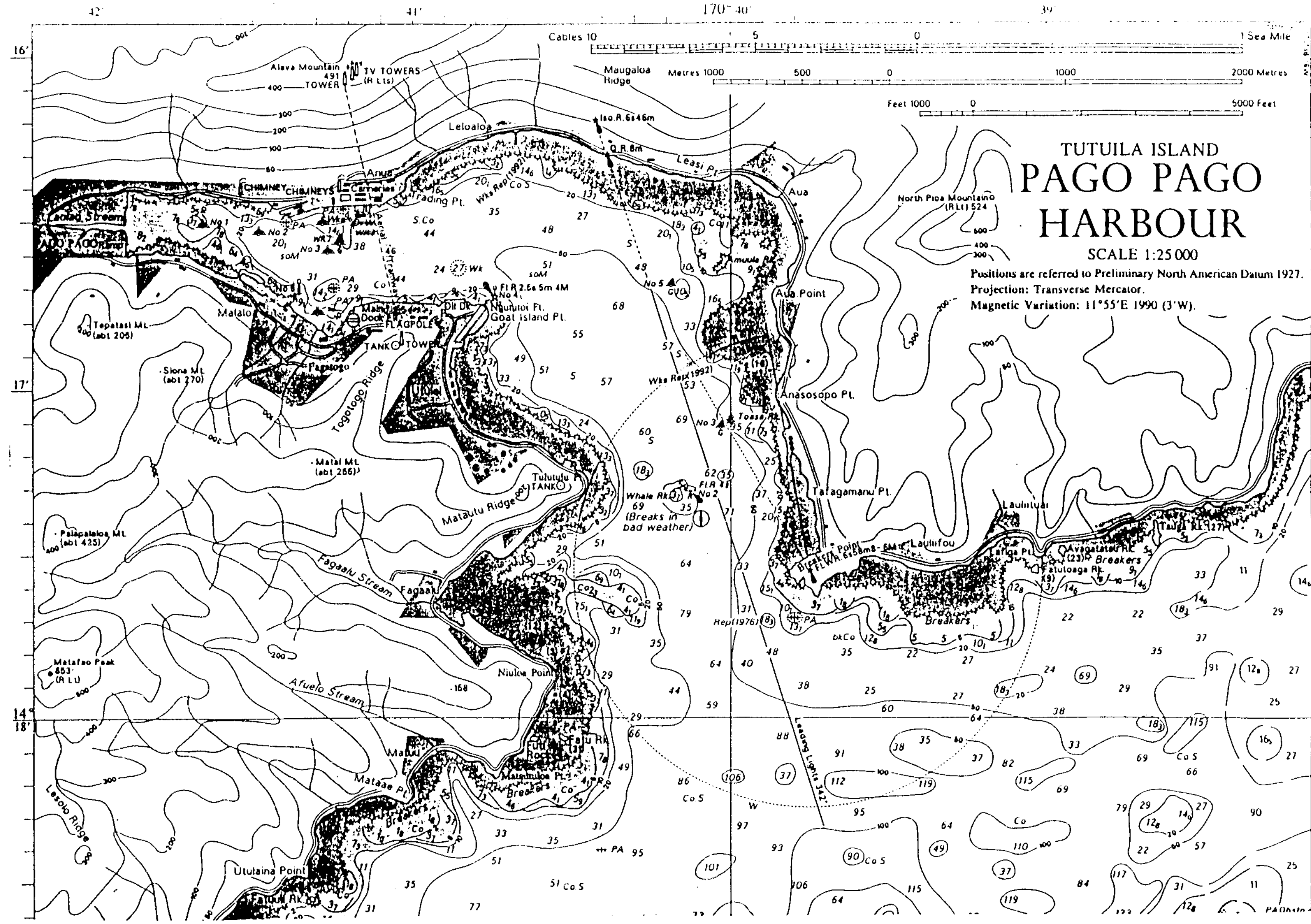

Figure 1-2
Pago Pago Harbor

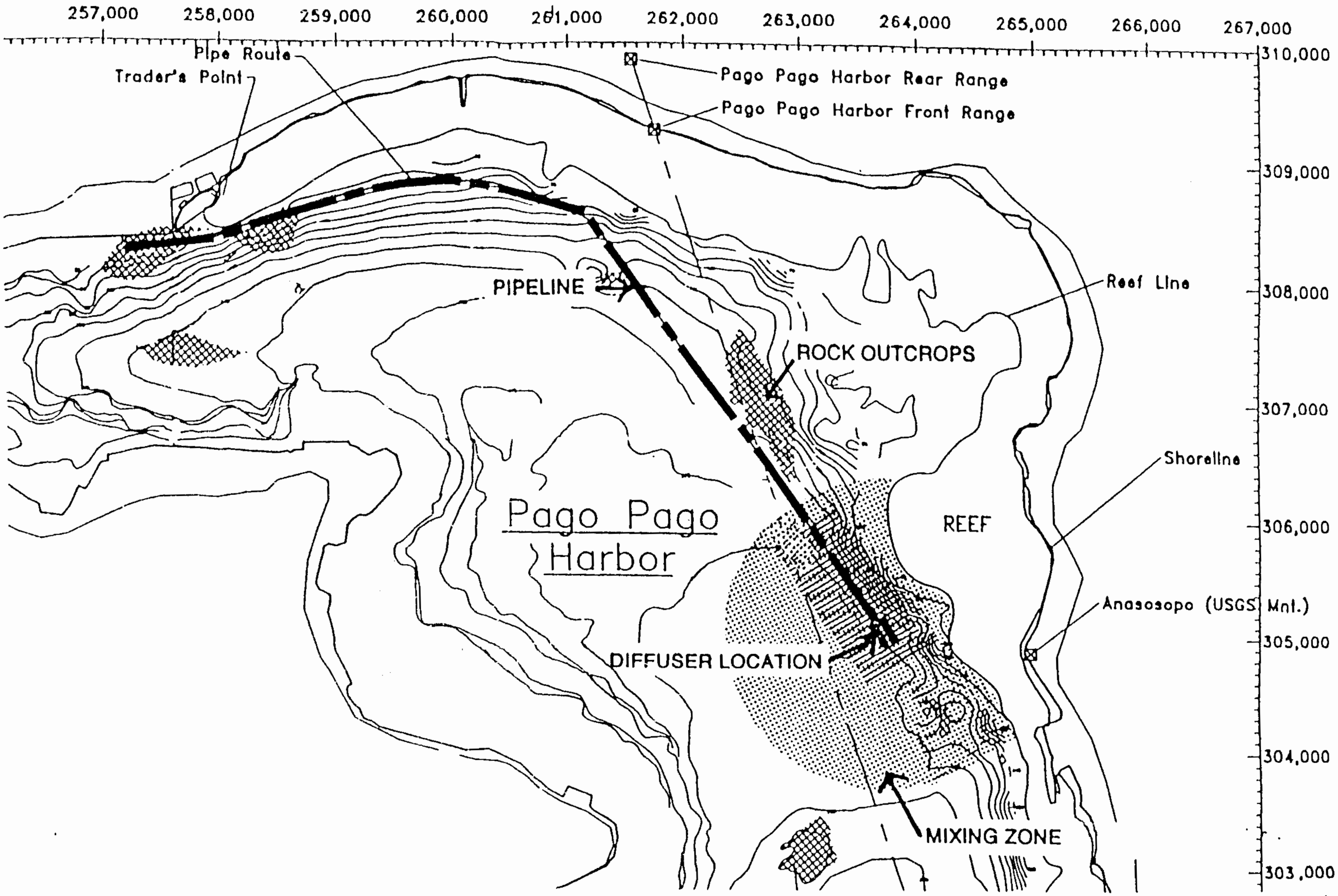

Figure 1-3
Outfall and Mixing Zone Location

2. FIELD DATA COLLECTION

A description of the field data collection during September 1997, including the methods used for field measurements and sample collection, are described below. The types of data collected and the locations, dates, and times of measurements and sample collection are summarized. Deviations from the SAP/SOP are listed and discussed.

2.1 GENERAL DESCRIPTION

The field work was conducted between 31 August and 4 September 1997. The activities conducted during this time period included:

- 31 August - Sampling at stations 9, 9A, 10, 10A, 11, 11A, 12, and 13
- 01 September - Sampling at stations 5, 5A, 15, 16, and 18
- 02 September - Sampling at stations 6, 6A, 7, 8, 8A, 14, and 17
- 04 September - Continuous profile hydrographic casts made at all stations

During sampling at designated stations water samples were collected for laboratory analysis using standard water sampling bottles (Niskin type bottles). Secchi depth and total water depth were measured at each station. Profile casts were made on 4 September 1997. The dissolved oxygen (DO) probe on the profiling instrument was checked prior to sampling, and was found to give unreliable readings. Attempts to field service the probe were unsuccessful. Therefore, DO was measured for each individual grab sample (at each station and each depth sampled) using a YSI DO meter (temperature and salinity internally compensated). pH was measured using a subsample from the chlorophyll-a sample at the time of filtering as described below.

The continuous profile hydrographic casts were done using a SeaBird conductivity, temperature, depth (CTD) instrument also equipped with DO, and turbidity probes. The DO probe was not functioning properly, as mentioned above, and the pH probe was not available. The meter records every 0.5 seconds on both the downcast and upcast. It is equipped with a pump to provide for sufficient flushing past the sensors.

The meteorological conditions during sampling was as follows:

- 31 August (AM) - Wind from E to SSE at 10 to 15 mph, heavy overcast with periodic rain, choppy seas
- 31 August (PM) - Wind from SSE to S at 15 mph, gusts to 20 mph, heavy overcast with periodic rain, choppy seas with 2 ft swells in middle harbor
- 01 September (AM) - Wind from ESE to SSE at 8 to 12 mph, heavy overcast, swell at 3 to 6 ft in harbor mouth decreasing to calm seas by mid-afternoon

- 02 September (PM) - Wind from SSE to S at 0 to 10 mph, overcast with periodic rain, swell at 2 to 6 ft in outer harbor
- 04 September (AM) - Wind from SE to S at 8 to 10 mph, heavy overcast, choppy and confused seas with swell at 1 to 6 ft outside the harbor mouth

Station locations are specified in the permit both by latitude and longitude and graphically. The problems with station specification associated with the differences between various map datums and the use of GPS was described in the report on the March 1996 sampling episode. We have recorded, and permanently stored, the WGS 1984 coordinates of the stations actually occupied for the March 1996 sampling and have used the same coordinates for all subsequent sampling episodes. The WGS coordinates occupied, and the times of station occupation, are given in Table 2-1. Figure 2-1 shows the relative locations of the stations occupied for this study.

2.2 DESCRIPTION OF FIELD METHODS

Direct field measurements included water depth, Secchi depth, and DO. In addition pH, was measured using subsamples of each grab sample. These measurements were conducted as follows:

- Water depth was measured using a non-recording portable fathometer which was occasionally checked by observing the signal produced as the Secchi disk or the SeaBird were lowered and raised through the water column
- Secchi depth was determined by using a 12-inch diameter white (quartered) Secchi disk lowered through the water column on a measured line
- DO was measured using aliquots of each sample as collected in the field using a YSI Model 50B meter following the manufactures instructions for use of the meter; the meter was frequently field calibrated before, during and after the sampling
- pH was measured using aliquots of grab samples collected for chlorophyll-a analysis using an Orion Model 250A pH meter. These samples are stored on ice and later filtered, a small subsample was used for the pH measurement.

As described above, conductivity, temperature, depth (pressure), and turbidity were measured using an internally recording profiling instrument (SeaBird CTD) which had been calibrated by the manufacturer prior to shipment to American Samoa. Salinity and sea water density were calculated from conductivity and temperature using the SeaBird supplied software.

Water samples were collected using a Niskin type sampling bottle from each depth specified in the permit (depths of collection at each station are shown in Table 2-1). The collection bottle was lowered to the appropriate depth using a measured line and allowed to hang for a minimum of 1 minute. A messenger was dropped down the line and the bottle was retrieved after being tripped by the messenger. Sample bottles as described in Table 2-2 were immediately filled and preserved as indicated in the table, stored on ice, and prepared for shipment to the laboratory as described in the SAP/SOP (Appendix II). In addition, a minimum of two liters was collected for chlorophyll-a analysis. The chlorophyll samples were later filtered through a Whatman grade GF/F glass fiber filter (0.7 microns) using a vacuum pump apparatus. The filters were treated with manganese sulfate as a preservative, frozen, and then hand carried to the laboratory for analysis.

2.3 DEVIATIONS FROM THE STUDY PLAN

As in any field data collection, problems and required solutions in the field, interpretation of the guidelines being used, weather, equipment malfunctions, and a variety of other factors may lead to deviations from the study plan. There were only minor deviations during this episode of field data collection which either had no substantial effect on the data recovered and in some cases actually enhanced the objectives of the study. The identified deviations for this study included the following:

- Discrete grab samples for measuring turbidity were collected, in addition to the profile data required by the permit, at selected stations in and around the mixing zone including stations 8, 8A, 14, 15, 16, 17, and 18
- DO was measured for all discrete grab samples for all stations occupied (and data from the continuous profile was discarded)
- pH was measured for all grab samples rather than as a continuous vertical profile

Table 2-1
PAGO PAGO HARBOR WATER QUALITY MONITORING STATION OCCUPATION SUMMARY
September 1997

Station Number	Sample Collection		CTD Casts[1]		Latitude 14° S[2]	Longitude 170° W[2]	Water Depth[3]	Secchi Depth[4,5]	Secchi Depth[4,6]	Sampling Depths
	Date	Time	Date	Time	(minutes)	(minutes)	(feet)	(feet)	(feet)	(feet)
TRANSITION ZONE										
5	9/01	09:15	9/04	08:55	17.713	39.733	150	NA[7]	45 (O)	S, 30, 60, 90, 120, B
5A	9/01	09:45	9/04	09:00	18.045	40.393	180	NA	42 (O)	S, 30, 60, 90, 120, B
OUTER HARBOR										
6	9/02	13:30	9/04	09:15	17.211	40.298	206	NA	45 (O)	S, 30, 60, 90, 120, B
6A	9/02	13:05	9/04	09:20	17.316	40.582	110	NA	43 (O)	S, 30, 60, 90, B
7	9/02	13:55	9/04	09:30	17.226	39.878	85	35 (O)	35 (O)	S, 30, 60, 90, B
8	9/02	14:15	9/04	09:45	16.843	40.098	184	29 (O)	35 (O)	S, 30, 60, 90, 120, B
18	9/01	10:25	9/04	09:40	17.092	40.041	185	32 (O)	19 (O)	S, 30, 60, 90, 120, B
MIDDLE HARBOR										
8A	9/02	15:05	9/04	09:55	16.826	40.150	160	28 (O)	25 (O)	S, 30, 60, 90, 120, B
9	8/31	13:55	9/04	10:35	16.562	40.194	108	38 (O)	19 (O)	S, 30, 60, B
9A	8/31	13:35	9/04	10:40	16.293	40.559	132	23 (O)	15 (O)	S, 30, 60, B
10	8/31	14:40	9/04	10:25	16.755	40.637	174	32 (O)	14 (O)	S, 30, 60, 90, 120, B
10A	8/31	14:15	9/04	10:20	16.997	40.451	108	36 (O)	17 (O)	S, 30, 60, B
14	9/02	14:40	9/04	09:50	16.911	40.065	170	27 (O)	31 (O)	S, 30, 60, 90, 120, B
15	9/01	11:25	9/04	10:05	16.584	40.116	100	33 (O)	32 (O)	S, 50, B
16	9/01	11:00	9/04	10:15	16.891	40.354	188	32 (O)	20 (O)	S, 30, 60, 90, 120, B
17	9/02	15:35	9/04	10:00	16.804	40.086	102	29 (O)	32 (O)	S, 30, B
INNER HARBOR										
11	8/31	11:15	9/04	10:50	16.480	40.947	120	22 (O)	13 (O)	S, 30, 60, 90, 120, B
11A	8/31	10:45	9/04	10:55	16.464	41.151	140	21 (O)	14 (O)	S, 30, 60, 90, 120, B
12	8/31	10:30	9/04	11:05	16.449	41.376	124	15 (O)	12 (O)	S, 50, B
13	8/31	09:35	9/04	11:10	16.304	41.841	34	8 (O)	8 (O)	S, 15, B

Notes:
[1] CTD casts were taken two days after the final sample collection, and were all done on the same day (4 September 1997)
[2] Coordinates are as recorded by GPS using the WGS coordinate system (see text for additional details).
[3] Water depths were recorded during the CTD casts.
[4] (O) = overcast (S) = sunny; (Sh) = shadows and/or low sun angle.
[5] Secchi Disc depth readings were taken during the CTD casts.
[6] Secchi Disc depth readings were taken during water sample collection.
[7] NA = Not Available

Table 2-2
PAGO PAGO HARBOR WATER QUALITY MONITORING SAMPLE ANALYSIS AND HANDLING PROCEDURES
September 1997

PARAMETER	REQUESTED ANALYTICAL METHOD	REQUESTED REPORTING DETECTION LIMIT	SAMPLE HOLDING TIME	SAMPLE CONTAINER	SAMPLE PRESERVATION
Temperature	Field Probe	0.1°C	N/A	N/A	none
Salinity	Field Probe	0.1 PSU	N/A	N/A	none
Dissolved O_2	Field Probe	0.1 mg/l	N/A	N/A	none
pH	Field Probe	0.1 SU	N/A	N/A	none
Turbidity	Field Probe	0.2 NTU	N/A	N/A	none
Turbidity[1]	EPA 180.1	0.01 NTU	48 hours [2]	100 ml plastic	none
Nitrite Nitrogen	EPA 354.1	0.001 mg/l	48 hours [2]	100 ml plastic	none
Nitrate + Nitrite	EPA 353.2	0.010 mg/l	28 days	2 - 500 ml plastic	4°C - H_2SO_4
Ammonia Nitrogen	EPA 350.1	0.005 mg/l	28 days		
Total Kheldal Nitrogen	EPA 351.3	0.025 mg/l	28 days		
Total Phosphorus	EPA 365.2	0.005 mg/l	28 days		
Chlorophyll-a	SM 1002 G	0.03 mg/cubic meter	3 months	Whatman (0.7 micron) GF/F filter	frozen, manganese sulfate
Zinc	EPA 200.7	20 µg/l	6 months	1 -liter plastic	4°C - HNO_3 to a pH of ≤ 2
Copper	EPA 220.2 [3]	2 µg/l	N/A	1-liter plastic	none [4]

Notes:

[1] Turbidity samples sent to lab from selected stations only to verify probe readings. Stations selected at discretion of field team leader.

[2] Holding times for turbidity and nitrite-nitrogen are unavoidably exceeded because of logistics involved in shipping from American Samoa. The laboratory (AMTEST) agreed to test for these constituents immediately upon receipt of the samples (turbidity and nitrate sample from same container).

[3] Analytical Resources, Inc. tested for copper using modified method EPA 200.7, following hot acid digestion and extraction by co-precipitation to achieve the required detection limit.

[4] Used for co-precipitation so no preservative required.

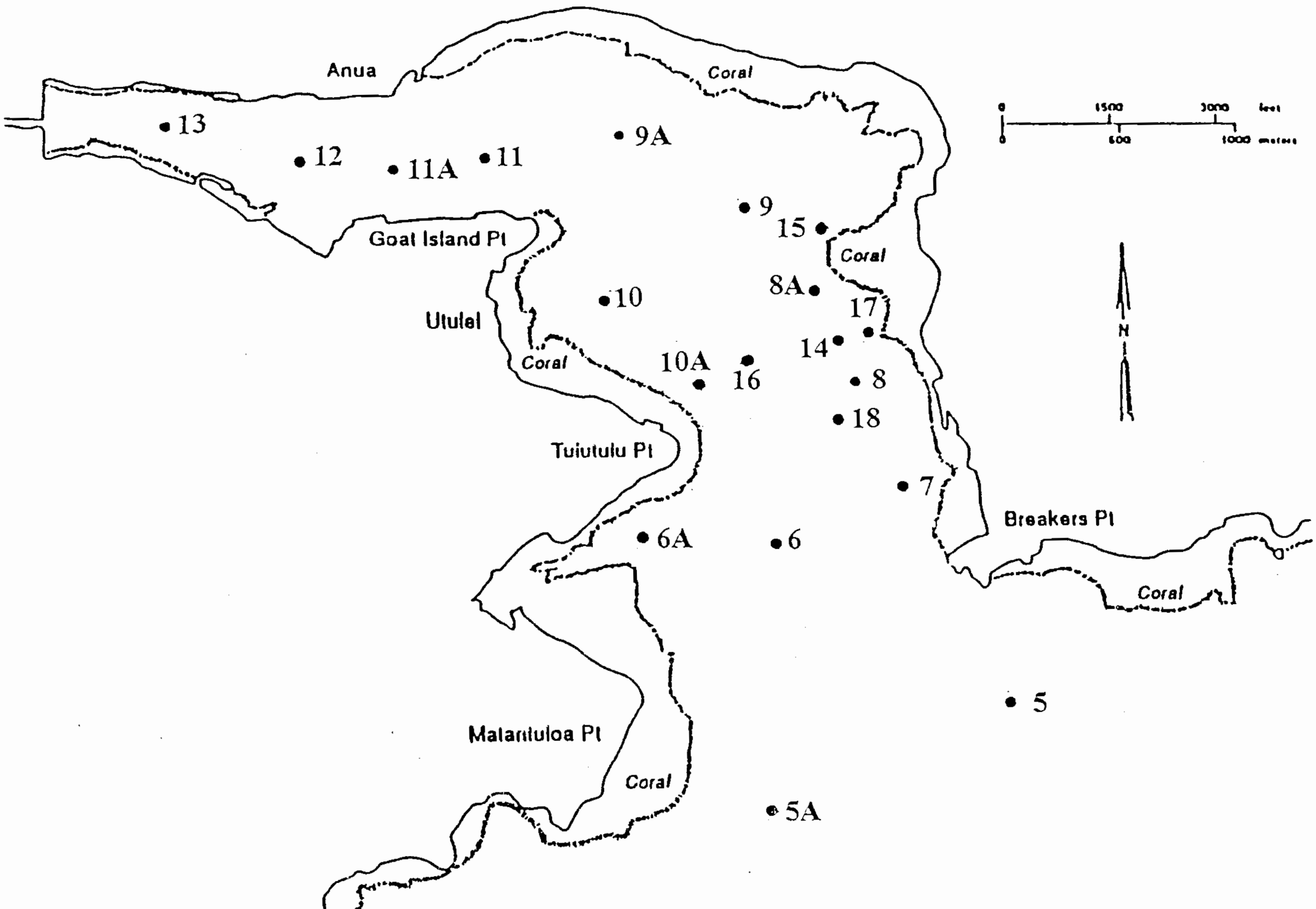

Figure 2-1
Station Locations

3. DATA SUMMARY

It is convenient to categorize the parameters measured in the field and laboratory during this study into three classes: physical and hydrographic parameters that generally describe the water column structure; nutrient and biological parameters that relate more to the health of the harbor; and trace metals. Physical and hydrographic parameters include temperature, salinity, density, DO, pH, turbidity, and Secchi depth, which is used as an indicator of light penetration. Nutrient and biological parameters include the various types of nitrogen, phosphorous, and chlorophyll-a. Zinc and copper were the trace metals of specific interest for this investigation. The results of the September 1997 sampling episode for each of these classes of parameters are presented below.

3.1 PHYSICAL HYDROGRAPHIC PARAMETERS.

The physical and hydrographic parameters measured in the field during the September 1997 harbor monitoring included (in addition to station location and total water depth): temperature, conductivity, dissolved oxygen, pH, turbidity, and light penetration by means of Secchi depth. Temperature, conductivity, and turbidity were measured as continuous vertical profiles. At selected stations turbidity was also measured in the laboratory using the water samples collected as described above. Salinity and density profiles were calculated from the CTD data using the SeaBird software.

Tables 3-1.a through 3-1.d summarize the vertical water column profile data collected with the CTD profiling instrument. The data plots of these hydrographic variables are provided in Appendix III. The Secchi depth measurements are presented in Table 2-1 above. The laboratory analyses for turbidity are given in Table 3-2. The measured values for DO and pH for each station and depth are given in Table 3-3. A brief description of each of the hydrographic parameters of interest is given below.

3.1.1 Temperature

Temperature summaries are given in Table 3-1.a. There was little variation in temperature throughout the harbor with measured values between 25.74 and 27.15 °C. Inner harbor temperature minimums were about one degree cooler than the open ocean. The vertical temperature variations for the inner and middle harbor was less than 1.5 degrees and less than 1 degree for the mixing zone and outer harbor. There was no identifiable effect of the discharge observable in or around the boundary of the mixing zone.

3.1.2 Salinity

Salinity summaries are provided in Table 3-1.b. As in the case of temperature, there was little variability in the mixing zone and outer harbor with stratification and vertical variations typically less than 1 ppt. There is no discernible influence from the JCO discharge. The middle and inner harbor had increasing stratification and vertical variations the closer the sample locations were to Pago Pago Creek. A distinct surface layer was observed in the inner harbor and was strongest near the creek mouth.

3.1.3 Density

Density in terms of sigma-t units (σ_t), is summarized in Table 3-1.c. The water column was generally well mixed with an indication of strong density gradients in the inner harbor. Vertical variations between surface and bottom were typically seen to be about 0.1 to 0.2 σ_t (1 σ_t is equivalent to 0.001 g/cm^3) at the harbor mouth, 0.2 to 0.7σ_t in the outer harbor and mixing zone, and 1.0 to 4.2 σ_t in the inner harbor. There was no discernible influence from the JCO discharge. As in the case of salinity, the middle and inner harbor had increasing stratification and vertical variations the closer the sample locations were to Pago Pago Creek.

3.1.4 Turbidity

Turbidity was measured throughout the water column using a SeaPoint optical sensor mounted on the SeaBird CTD. The turbidity sensor was set for the highest resolution and lowest range and threshold possible. At these settings, the minimum reading of the instrument was approximately 0.04 NTU and the resolution was 0.01 NTU. That means any value lower than 0.04, even a value of zero, was recorded as 0.04 NTU. Conversations with the manufacturers of both the turbidity meter and the CTD on which it was mounted indicate the a portion of the 0.04 NTU lowest reading is an instrument offset and can be subtracted from the actual reading. However, this value is not easily determined and appropriate tests were not done to define this value in the field. Therefore, the data including the small offset is presented in this report. It is recognized that all values may be reported slightly higher than they should be and the sensor detection limit is lower than 0.04 NTU.

The data from the turbidity profiles is summarized for each station in Table 3-1.d. A slightly higher turbidity layer ($\leq$ 0.2 NTU) was observed near bottom at stations 8A, 11A, 14, 10, and 18 (see plots in Appendix III). The average values throughout the water column were low, generally less than 0.05 NTU. The ASWQS for turbidity is 0.75 NTU (<u>median</u> value). The mean value for the continuous profiles at each station were between 0.04 and 0.05 NTU. Compliance with the ASWQS is achieved based on the profile data. Because of the instrument characteristics, the potential problem of a undefined offset was recognized in the field and turbidity analysis was requested on selected samples in and around the mixing zone. Samples from all stations within the mixing zone and on the mixing zone boundary were sampled for turbidity analysis. The data are given in Table 3-2 and indicate compliance with ASWQS. It is noted that the laboratory analysis indicates generally higher values than the profiling sensor which may be caused by the unavoidable holding times of the samples. However, ASWQS for turbidity is achieved regardless of the data considered (profile or laboratory analysis).

3.1.5 Dissolved Oxygen

There was both vertical and longitudinal spatial variability and temporal variability of DO indicated in the data provided in Table 3-3, as was expected. There is sufficient temporal variability, depending on time of day the measurement was taken, to mask any overall trends in longitudinal spatial variation. There was a distinct vertical trend with slightly higher DO values found near the surface at most stations. A small subsurface increase in DO was seen at Station 5 and 7. DO was below 6 mg/l but above 5 mg/l at nine stations, generally in the deeper samples. One station (station 13) was less than 5 mg/l. Mixing zone interior stations 8, 8A, and 14 had slightly depressed DO at bottom. Mixing zone edge station 15 had slightly depressed DO at bottom and 50 feet as was middle harbor stations 9 and 9A at bottom. Slightly depressed DO readings were also recorded at inner harbor station 11 at 120 feet and station 11A at 90 feet. Bottom DO reading at station 13 was recorded at 4.30 mg/l. The low DO reading at station 13 was most likely a result of its proximity to Pago Pago Creek, combined with poor vertical mixing in the inner harbor.

[The American Samoa water quality standard (ASWQS) specifies that DO shall be "*Not less than 70 percent of saturation or less than 5.0 mg/l. If the natural level of dissolved oxygen is less than 5.0 mg/l, the natural level will become the standard.*"] The measured DO for all stations was above the numerical American Samoa water quality standard.

3.1.6 pH Measurements

Table 3-3 summarizes the pH readings obtained during the study. There are small differences (with ranges between 7.64 and 8.33) observed but with no distinct trends along the harbor axis. Surface values are slightly lower than those at depth at about the same number of stations where the reverse is apparent. No effect of the discharge can be observed.

Measured pH values ranged from 7.6 to 8.3 which meets the ASWQS numerical standard at all locations. [The ASWQS is the "*The pH range shall be 6.5 to 8.6 and be within 0.2 pH unit of that which would occur naturally.*"] The natural value for marine waters is generally considered to be in the range of 7.5 to 8.4. For near surface waters (water in equilibrium with atmospheric CO_2), pH is typically about 8.1 to 8.2. Variability in coastal waters will be more extreme and freshwater inflows will tend to depress the values.

3.1.7 Secchi Depth

Secchi depths are presented in Table 2-1 above. Secchi depths were measured during the CTD casts and during the water sample collection. During most of the water sample collection weather conditions were windy, rainy and heavily overcast. The values recorded show a trend, increasing from the inner harbor to the outer harbor as would be expected. This trend is somewhat masked by the overcast conditions present during all observations and thus Secchi depths will be substantially understated compared to those collected under standard clear sky conditions. The Secchi depths observed in the inner harbor range from 8 to 22 feet.

The Secchi depth was 8 feet at Station 13 which is the inner most station, in a total water depth of about 34 feet.

The ASWQS is in terms of light penetration, which cannot be directly converted from Secchi or turbidity readings. However, some estimates can be made with light penetration being estimated by Secchi depth using the following approximation:

$$\chi = \kappa \cdot D^{-1}$$

where

χ = extinction coefficient for visible light

κ = a constant

and

D = Secchi depth in meters for a 30 cm Secchi disk.

The constant κ is not easily determined but is often taken as 1.7 based on data from the English Channel (Sverdrup, 1942). Using the above approximation, the depth of light penetration of 1 percent corresponds to a Secchi depth of 24 feet. Such a calculation corresponds to Secchi readings taken at high sun angles and in full sun light. As pointed out above, this was not possible during times of data collection in September 1997. Based on a review of previous data, the Secchi depth corresponding to light penetration of 1 percent under conditions during the measurements is likely less than half of that calculated above ($\leq$ 12 feet).

The ASWQS state that light penetration of 1 percent of the incident light should penetrate to a depth of 65 feet 50 percent of the time. As calculated above this corresponds to Secchi depth of approximately 24 feet (under appropriate conditions). Secchi depth was lower than 24 feet at all stations measured on 31 August in both the middle and inner harbor. The additional Secchi depths measurement on 17 September show higher Secchi depths at all stations with the exception of 14 and 17 in the middle harbor. The data can not be rigorously used to evaluate compliance, however experience and judgment clearly indicate that ASWQS for light penetration is being satisfied throughout the harbor.

3.2 NUTRIENT AND BIOLOGICAL PARAMETERS

Parameters to evaluate potential impacts of biological productivity included nutrients and chlorophyll-a. Nutrients included total phosphorus, total Kheldal nitrogen (TKN), ammonia nitrogen, nitrate plus nitrite, and nitrite nitrogen. ASWQS apply to total nitrogen (TN) which can be calculated by adding the nitrogen components, noting that ammonia is included in TKN. Table 2-2 above indicates the nutrient constituents measured and the methods used in the laboratory. Samples were prepared for chlorophyll-a analysis by filtering 1 to 2 liters of water through a filter (see Table 2.2) using a vacuum pump apparatus. The filters were treated with manganese sulfate as a preservative, frozen, and then sent to the laboratory for analysis.

The laboratory used for the analyses was AMTEST, located in Redmond, WA. Samples were stored on ice in American Samoa and shipped on ice via DHL to the laboratory. The Chlorophyll-a samples were kept frozen and hand carried to the laboratory. Laboratory chain-of-custody forms and analytical results are provided in Appendices IV and V, respectively. Each of the nutrient and parameters are discussed below based on the data summarized in Table 3-4.

3.2.1 Total Nitrogen

The numerical standard (median value) for total nitrogen (TN) is 200 µg/l. None of the 100 measurements were above this value. The highest TN value was 180 µg/l at Station 16 at the surface, which is located at the edge of the mixing zone. The ASWQS for TN is met throughout the harbor and within the mixing zone at the time of sampling.

3.2.2 Total Phosphorus

The numerical standard for total phosphorus (median value) is 30 µg/l. As shown in Table 3-4, thirteen of the 100 measurements from six stations (5, 10A, 11, 11A, 12, and 13) were above this value. For these thirteen measurements, values ranged from 31 - 43 µg/l. The median values for stations 5, 10A, 11, 11A, 12, and 13 are 27, 29, 28, 29.5. 34.3, and 37 µg/l respectively. None of the mixing zone station measurements had high total phosphorous values. With the exception of the stations indicated above, the remaining fifteen stations met the ASWQS for TP at the time of sampling. Examination of the other water column constituents provides no evidence that the elevated values of total phosphorous are attributable to the JCO discharge.

3.2.3 Chlorophyll-a

The numerical standard (median) for chlorophyll-a is 1 µg/l. Thirteen (13) of the 20 stations exhibited chlorophyll-a values at the surface higher than 1.0 µg/l. In addition to a high surface chlorophyll-a value station 16 also had a high chlorophyll-a value at bottom (2.1 µg/l) . At all thirteen stations the depth median was below the ASWQS of 1.0 µg/l. The mean and median values for the harbor were less than 1.0 µg/l and the mean value for each station was below 1.0 µg/l.

3.3 Zinc and Copper Concentrations

Zinc and copper were measured at specified stations and depths. Samples were collected and preserved as described above and in the SAP/SOP (Appendix II). Table 3-5 summarizes the results of the metals analyses. The chain-of-custody forms and laboratory results are provided in Appendices IV and VI, respectively. All analyses resulted in reported values less than detection limits, with the exception of Station 13 near surface copper concentration (2.8 µg/l), Station 13 near bottom copper concentration (1.0 μg/l), and Station 15 near surface copper concentration (0.6 μg/l). The reason for conducting these analyses is to provide receiving water data for the assessment of a mixing zone for these two metals. The data for both zinc and copper were adequate for this purpose with detection limits of <20 μg/l and < 0.5 μg/l, well below the water quality criteria.

Table 3-1.a Summary of Temperature Measurements (°C) from Continuous Vertical Profiles Pago Pago Harbor Water Quality Modeling 4 September 1997					
Station	Maximum	Minimum	Median	Average	Standard Deviation
Transition Zone					
5	27.11	26.88	27.02	27.01	0.06
5A	27.15	26.93	27.13	27.09	0.08
Outer Harbor					
6	27.13	26.39	27.11	26.98	0.26
6A	27.13	26.34	27.12	26.91	0.32
7	27.13	26.53	27.10	27.04	0.14
Mixing Zone - Interior					
8	27.13	26.46	27.11	27.07	0.14
8A	27.14	26.48	27.11	27.04	0.18
14	27.14	26.48	27.11	27.05	0.18
Mixing Zone - Edge					
15	27.13	26.36	27.11	27.00	0.21
16	27.13	26.53	27.11	27.04	0.16
17	27.14	26.44	27.11	27.01	0.23
18	27.13	26.50	27.11	27.05	0.15
Middle Harbor					
9	27.13	26.30	27.10	26.96	0.27
9A	27.14	26.04	27.10	26.95	0.33
10	27.13	26.33	27.11	27.00	0.25
10A	27.13	26.83	27.12	27.08	0.07
Inner Harbor					
11	27.15	26.05	27.10	26.98	0.29
11A	27.14	25.81	27.11	26.99	0.30
12	27.14	25.78	27.10	26.95	0.33
13	27.03	25.74	26.96	26.70	0.43

Table 3-1.b Summary of Salinity Measurements (ppt) from Continuous Vertical Profiles Pago Pago Harbor Water Quality Modeling 4 September 1997					
Station	Maximum	Minimum	Median	Average	Standard Deviation
Transition Zone					
5	35.44	35.16	35.35	35.33	0.06
5A	35.47	35.26	35.40	35.38	0.06
Outer Harbor					
6	35.55	34.53	35.38	35.26	0.30
6A	35.49	34.50	35.37	35.17	0.34
7	35.39	34.78	35.37	35.31	0.14
Mixing Zone - Interior					
8	35.55	34.50	35.38	35.34	0.19
8A	35.45	34.49	35.38	35.28	0.25
14	35.48	34.52	35.38	35.29	0.24
Mixing Zone - Edge					
15	35.38	34.32	35.35	35.21	0.29
16	35.55	34.63	35.38	35.32	0.22
17	35.38	34.48	35.36	35.22	0.30
18	35.54	34.61	35.38	35.33	0.19
Middle Harbor					
9	35.38	34.24	35.35	35.16	0.37
9A	35.38	33.72	35.36	35.13	0.49
10	35.49	34.28	35.38	35.23	0.34
10A	35.39	35.06	35.37	35.33	0.09
Inner Harbor					
11	35.41	33.40	35.37	35.20	0.41
11A	35.39	31.87	35.37	35.10	0.68
12	35.38	30.87	35.36	35.01	0.80
13	35.13	29.00	34.85	33.99	1.67

Table 3-1.c Summary of Sigma-t Measurements (σ_t) from Continuous Vertical Profiles Pago Pago Harbor Water Quality Modeling 4 September 1997					
Station	Maximum	Minimum	Median	Average	Standard Deviation
Transition Zone					
5	23.08	22.87	22.98	22.96	0.03
5A	23.06	22.92	22.98	22.98	0.02
Outer Harbor					
6	23.12	22.55	22.97	22.92	0.15
6A	23.12	22.55	22.96	22.88	0.16
7	22.98	22.69	22.96	22.94	0.06
Mixing Zone - Interior					
8	23.11	22.51	22.97	22.95	0.10
8A	23.02	22.50	22.96	22.92	0.13
14	23.04	22.52	22.97	22.92	0.13
Mixing Zone - Edge					
15	22.97	22.38	22.95	22.88	0.15
16	23.11	22.59	22.97	22.94	0.12
17	22.97	22.49	22.95	22.88	0.16
18	23.10	22.59	22.97	22.95	0.10
Middle Harbor					
9	22.97	22.37	22.95	22.86	0.19
9A	22.98	22.05	22.95	22.84	0.27
10	23.10	22.39	22.97	22.90	0.18
10A	22.98	22.79	22.96	22.94	0.05
Inner Harbor					
11	23.00	21.80	22.96	22.87	0.22
11A	22.98	20.74	22.96	22.80	0.42
12	22.97	19.99	22.95	22.75	0.50
13	22.81	18.59	22.63	22.05	1.13

Table 3-1.d Summary of Turbidity Measurements (NTU) from Continuous Vertical Profiles Pago Pago Harbor Water Quality Modeling 4 September 1997					
Station	Maximum	Minimum	Median	Average	Standard Deviation
Transition Zone					
5	0.05	0.04	0.04	0.04	0.00
5A	0.09	0.04	0.04	0.04	0.00
Outer Harbor					
6	0.07	0.04	0.04	0.04	0.00
6A	0.05	0.04	0.04	0.04	0.00
7	0.05	0.04	0.04	0.04	0.00
Mixing Zone - Interior					
8	0.09	0.04	0.04	0.05	0.01
8A	0.17	0.04	0.04	0.05	0.03
14	0.18	0.04	0.04	0.05	0.03
Mixing Zone - Edge					
15	0.05	0.04	0.04	0.04	0.00
16	0.09	0.04	0.04	0.05	0.01
17	0.05	0.04	0.04	0.04	0.00
18	0.14	0.04	0.04	0.05	0.01
Middle Harbor					
9	0.05	0.04	0.04	0.04	0.00
9A	0.09	0.04	0.04	0.04	0.01
10	0.11	0.04	0.04	0.04	0.01
10A	0.05	0.04	0.04	0.04	0.00
Inner Harbor					
11	0.08	0.04	0.04	0.04	0.01
11A	0.21	0.04	0.04	0.05	0.02
12	0.09	0.04	0.05	0.05	0.01
13	0.08	0.05	0.05	0.05	0.01

Table 3-2
Results of Laboratory Analyses of Turbidity for Selected Stations
Pago Pago Harbor Water Quality Monitoring
September 1997

	Turbidity at Station Depths Indicated (NTU)								
Depth (feet)[1]	S	**30**	**50[2]**	**60**	**90**	**120**	**B**	**Average**	**Median**
Stations									
Mixing Zone Interior									
8	0.18	0.08	-	0.07	0.09	0.23	0.12	0.13	0.11
8A	0.32	0.09	-	0.06	0.17	0.11	0.07	0.14	0.10
14	0.23	0.12	-	0.08	0.07	0.11	0.15	0.13	0.12
ZOM Boundary									
15[3]	0.16	-	0.08	-	-	-	0.10	0.11	0.10
16	0.21	0.10	-	0.17	0.13	0.04	0.26	0.15	0.15
17[4]	0.21	0.09	-	-	-	-	0.14	0.15	0.14
18	0.19	0.16	-	0.07	0.08	0.10	0.30	0.15	0.13

Notes:
[1] S = Near Surface (within 1 meter of the surface); B= Near Bottom (within 1 meter of the bottom)
[2] 50 feet was used as mid depth for station 15 only
[3] Station 15 sampled at only three depths as shown
[4] Stations 17 sampled at only three depths as shown

Table 3-3
Dissolved Oxygen and pH measurements
Pago Pago Harbor Water Quality Monitoring - September 1997

Station	Depth	DO (mg/l)	pH (SU)[1]	Station	Depth	DO (mg/l)	pH (SU)[1]
5	SURF	6.37	8.09	10A	SURF	6.92	8.04
	30	6.43	8.00		30	6.29	8.06
	60	6.50	8.27		60	6.12	8.14
	90	6.49	7.91		BOTM	6.23	8.14
	120	6.46	8.05				
	BOTM	6.31	8.16				
5A	SURF	6.37	8.13	11	SURF	6.61	8.22
	30	6.32	8.03		30	6.42	7.82
	60	6.33	8.12		60	5.92	8.10
	90	6.32	8.21		90	6.15	8.17
	120	6.31	7.85		120	5.99	8.02
	BOTM	6.30	8.08		BOTM	6.01	8.23
6	SURF	6.63	7.77	11A	SURF	6.35	8.10
	30	6.51	8.04		30	6.34	8.22
	60	6.53	8.10		60	6.04	8.16
	90	6.46	8.18		90	5.74	8.12
	120	6.45	8.29		120	6.15	8.33
	BOTM	6.06	8.10		BOTM	6.10	8.32
6A	SURF	6.74	8.08	12	SURF	6.30	8.14
	30	6.50	7.79		50	6.00	8.21
	60	6.44	7.89		BOTM	6.04	8.27
	90	6.43	7.92				
	BOTM	6.41	8.18				
7	SURF	6.54	8.14	13	SURF	6.48	8.00
	30	6.67	8.14		15	5.40	8.21
	60	6.45	8.16		BOTM	4.30	8.22
	90	6.40	8.05				
	BOTM	6.40	7.77				
8	SURF	6.73	8.17	14	SURF	6.72	7.72
	30	6.54	7.80		30	6.45	7.87
	60	6.52	8.00		60	6.49	8.02
	90	6.47	7.93		90	6.47	8.00
	120	6.27	7.91		120	6.38	NA
	BOTM	5.85	7.88		BOTM	5.91	8.21
8A	SURF	6.81	8.02	15	SURF	6.59	7.89
	30	6.44	8.00		50	5.87	7.83
	60	6.43	8.10		BOTM	5.82	7.74
	90	6.36	8.14				
	120	5.92	8.06				
	BOTM	5.94	8.10				
9	SURF	7.11	8.24	16	SURF	6.69	8.16
	30	6.25	8.27		30	6.26	7.91
	60	6.00	8.25		60	6.26	8.02
	BOTM	5.75	8.16		90	6.31	8.07
					120	6.26	8.00
					BOTM	6.08	7.93
9A	SURF	7.04	8.04	17	SURF	6.78	7.98
	30	6.07	8.04		30	6.38	8.06
	60	5.90	7.86		BOTM	6.30	7.64
	BOTM	5.73	8.02				
10	SURF	7.50	8.06	18	SURF	6.60	8.17
	30	6.12	8.04		30	6.11	8.06
	60	6.26	8.17		60	6.37	8.09
	90	6.32	8.11		90	6.37	8.14
	120	6.20	8.14		120	6.31	7.99
	BOTM	6.22	8.08		BOTM	6.18	8.06

[1] pH values were measured in chlorophyll-a samples during filtering.

Table 3-4 Nutrients and Chlorophyll-a Measurements Pago Pago Harbor Water Quality Monitoring September 1997							
Station	**Depth**	**Chlorophyll-a (mg/m^3)**	**Ammonia Nitrogen (mg/l)**	**TKN (mg/l)**	**Nitrate + Nitrite (mg/l)**	**Nitrite Nitrogen (mg/l)**	**Total Phosphorus (mg/l)**
5	SURF	0.41	<0.005	0.028	<0.01	<0.001	0.030
	30	0.46	<0.005	0.10	<0.01	0.003	0.030
	60	<0.03	<0.005	0.076	<0.01	0.001	0.032
	90	0.23	<0.005	0.040	<0.01	0.003	0.018
	120	0.43	<0.005	0.038	<0.01	0.002	0.031
	BOTM	0.47	<0.005	<0.025	<0.01	0.010	0.023
5A	SURF	1.2	<0.005	0.090	0.012	<0.001	0.016
	30	0.67	<0.005	0.085	<0.01	0.002	0.019
	60	<0.03	<0.005	0.076	<0.01	0.004	0.021
	90	0.22	<0.005	0.076	<0.01	0.002	0.019
	120	<0.03	<0.005	0.086	<0.01	0.004	0.020
	BOTM	0.45	<0.005	0.079	<0.01	0.009	0.021
6	SURF	1.9	<0.005	0.060	<0.01	<0.001	0.016
	30	0.24	<0.005	0.090	<0.01	<0.001	0.010
	60	0.24	<0.005	0.086	<0.01	<0.001	0.015
	90	0.23	<0.005	0.085	<0.01	<0.001	0.017
	120	0.24	<0.005	<0.025	<0.01	<0.001	0.018
	BOTM	<0.03	<0.005	<0.025	<0.01	<0.001	0.021
6A	SURF	<0.03	<0.005	<0.025	<0.01	<0.001	0.018
	30	0.22	<0.005	<0.025	<0.01	<0.001	0.022
	60	0.24	<0.005	0.055	<0.01	<0.001	0.023
	90	<0.03	<0.005	<0.025	0.050	<0.001	0.023
	BOTM	0.44	<0.005	<0.025	<0.01	<0.001	0.012
7	SURF	0.81	<0.005	<0.025	<0.01	<0.001	0.014
	30	0.21	<0.005	<0.025	0.011	<0.001	0.013
	60	0.45	<0.005	<0.025	<0.01	<0.001	0.016
	90	<0.03	<0.005	0.054	<0.01	<0.001	0.017
	BOTM	0.39	<0.005	<0.025	<0.01	<0.001	0.019
8	SURF	0.47	<0.005	<0.025	0.013	<0.001	0.025
	30	0.44	<0.005	<0.025	<0.01	<0.001	0.024
	60	0.44	<0.005	<0.025	<0.01	<0.001	0.018
	90	<0.03	<0.005	<0.025	<0.01	<0.001	0.023
	120	0.23	0.011	0.060	<0.01	<0.001	0.016
	BOTM	<0.03	<0.005	0.040	0.012	<0.001	0.015
8A	SURF	1.6	<0.005	<0.025	0.019	<0.001	0.016
	30	0.87	<0.005	<0.025	<0.01	0.004	0.017
	60	<0.03	<0.005	<0.025	<0.01	0.003	0.019
	90	<0.03	<0.005	<0.025	<0.01	<0.001	0.026
	120	0.21	<0.005	<0.025	0.011	<0.001	0.025
	BOTM	0.22	<0.005	<0.025	0.012	<0.001	0.022
9	SURF	2.9	<0.005	0.054	<0.01	0.002	0.030
	30	0.32	<0.005	0.13	<0.01	0.003	0.030
	60	0.21	<0.005	0.037	<0.01	0.004	0.019
	BOTM	0.23	<0.005	<0.025	<0.01	0.007	0.026
9A	SURF	0.19	<0.005	0.042	<0.01	0.003	0.018
	30	0.6	<0.005	0.081	<0.01	0.003	0.025
	60	<0.03	0.006	<0.025	<0.01	<0.001	0.022
	BOTM	0.21	<0.005	<0.025	<0.01	0.001	0.028

Table 3-4 - continued							
Station	**Depth**	**Chlorophyll-a (mg/m^3)**	**Ammonia Nitrogen (mg/l)**	**TKN (mg/l)**	**Nitrate + Nitrite (mg/l)**	**Nitrite Nitrogen (mg/l)**	**Total Phosphorus (mg/l)**
10	SURF	4.6	<0.005	<0.025	<0.01	0.012	0.024
	30	0.89	<0.005	<0.025	<0.01	0.014	0.025
	60	<0.03	<0.005	<0.025	<0.01	0.015	0.026
	90	<0.03	<0.005	<0.025	<0.01	0.005	0.029
	120	<0.03	<0.005	0.090	<0.01	0.005	0.030
	BOTM	<0.03	<0.005	0.090	<0.01	0.003	0.029
10A	SURF	2.0	0.008	0.036	<0.01	0.002	0.032
	30	0.76	0.008	<0.025	<0.01	0.006	0.034
	60	<0.03	<0.005	<0.025	<0.01	0.003	0.023
	BOTM	<0.03	<0.005	<0.025	<0.01	0.005	0.026
11	SURF	4.1	0.006	0.065	0.022	0.019	0.030
	30	1.3	<0.005	<0.025	<0.01	0.002	0.037
	60	<0.03	0.012	0.095	<0.01	0.003	0.033
	90	<0.03	<0.005	0.031	<0.01	0.004	0.031
	120	<0.03	<0.005	<0.025	<0.01	0.001	0.020
	BOTM	0.21	<0.005	<0.025	<0.01	0.002	0.018
11A	SURF	2.5	0.022	0.084	0.031	0.008	0.025
	30	1.0	<0.005	<0.025	<0.01	0.004	0.028
	60	0.45	<0.005	<0.025	<0.01	0.008	0.030
	90	<0.03	<0.005	0.056	<0.01	0.007	0.033
	120	0.2	<0.005	0.029	<0.01	0.004	0.030
	BOTM	<0.03	<0.005	0.027	<0.01	0.007	0.031
12	SURF	1.8	0.052	0.12	0.030	0.010	0.034
	50	0.23	0.009	0.055	<0.01	0.002	0.037
	BOTM	<0.03	<0.005	0.031	<0.01	0.002	0.032
13	SURF	2.1	0.034	0.091	0.036	<0.001	0.043
	15	0.64	0.073	0.12	0.018	<0.001	0.034
	BOTM	0.4	0.10	0.11	0.016	0.008	0.034
14	SURF	1.4	<0.005	0.047	0.016	<0.001	0.023
	30	<0.03	<0.005	0.043	<0.01	<0.001	0.020
	60	0.21	<0.005	<0.025	<0.01	<0.001	0.009
	90	0.23	<0.005	<0.025	0.01	0.001	0.008
	120	<0.03	<0.005	<0.025	<0.01	0.001	0.012
	BOTM	<0.03	<0.005	<0.025	0.012	<0.001	0.019
15	SURF	0.12	<0.005	0.10	0.011	0.009	0.024
	50	0.23	<0.005	<0.025	<0.01	0.001	0.026
	BOTM	1.0	<0.005	0.15	0.014	0.002	0.019
16	SURF	1.6	<0.005	0.18	0.016	<0.001	0.023
	30	0.23	<0.005	0.050	<0.01	<0.001	0.018
	60	0.23	<0.005	0.11	<0.01	<0.001	0.022
	90	<0.03	<0.005	0.10	0.010	<0.001	0.019
	120	0.25	<0.005	0.079	0.026	<0.001	0.020
	BOTM	2.1	<0.005	0.10	0.029	0.001	0.023
17	SURF	1.2	<0.005	<0.025	0.017	<0.001	0.023
	30	0.47	<0.005	<0.025	<0.01	<0.001	0.021
	BOTM	0.21	<0.005	<0.025	<0.01	<0.001	0.021
18	SURF	0.67	<0.005	0.045	0.037	0.006	0.025
	30	0.31	0.007	0.070	<0.01	<0.001	0.023
	60	<0.03	<0.005	0.075	0.032	<0.001	0.022
	90	<0.03	<0.005	0.075	0.015	0.006	0.013
	120	0.32	<0.005	<0.025	<0.01	<0.001	0.012
	BOTM	<0.03	<0.005	<0.025	<0.01	<0.001	0.009

Table 3-5 Zinc and Copper Analysis Results Pago Pago Harbor Water Quality Monitoring September 1997			
Station	**Depth (ft)**	**Zinc Concentration (µg/l)**	**Copper Concentration (µg/l)**
Transition Zone			
5	30	<20	<0.5
	120	<20	<0.5
	Near Bottom	<20	<0.5
5A	30	<20	<0.5
	120	<20	<0.5
	Near Bottom	<20	<0.5
Inner Harbor			
11	30	<20	<0.5
	120	<20	<0.5
	Near Bottom	<20	<0.5
13	Near Surface	<20	2.8
	Near Bottom	<20	1.0
ZOM Boundary			
15	Near Surface	<20	0.6
	50	<20	<0.5
	Near Bottom	<20	<0.5
16	30	<20	<0.5
	120	<20	<0.5
	Near Bottom	<20	<0.5
18	30	<20	<0.5
	120	<20	<0.5
	Near Bottom	<20	<0.5

4. CONCLUSIONS AND RECOMMENDATIONS

The fourth semiannual Receiving Water Quality Monitoring study was successfully completed with only minor deviations from the SAP/SOP. With the exception of total phosphorus at a few stations the data indicate compliance with ASWQS throughout the harbor. The stations with the highest depth averaged total phosphorus were inner harbor Stations 12 and 13. More stations than typically observed had individual depth measurements of higher chlorophyll-a during the September 1997 sampling. Secchi depths were abnormally low during this sampling. The weather conditions during the September 1997 sampling, being windy and rainy, could have a strong relationship to harbor conditions observed.

The water quality standards are based on median values of many constituent concentrations, and the standards were fully achieved on this basis. The numerical values, on which the standards are based, are occasionally exceeded at individual stations (although this does not necessarily mean water quality standards are violated). However, in no instance inside or outside the mixing zone, can the individual excursions above the criteria be attributed to the JCO discharge. The canneries are in compliance with the applicable conditions of the NPDES permits.

No general recommendations are made for conducting future sampling episodes of water quality monitoring.

5. REFERENCES

CH2M HILL, 1991. Engineering and Environmental Feasibility Evaluation of Waste Disposal Alternatives. Prepared for StarKist Samoa, Final Report, March 1991.

CH2M HILL and Glatzel and Associates, 1995. Results of March 1995 Harbor Water Quality Monitoring, Pago Pago American Samoa.

CH2M HILL and **gdc**, 1997. Receiving Water Quality Monitoring Report: Pago Pago Harbor, American Samoa: March 1996 Sampling. 6 March 1996.

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Environmental Protection Agency, Region 10, 1992. Authorization to Discharge Under the National Pollution Discharge Elimination System; Permit No. AS0000019, Issued to StarKist Samoa, Inc., 24 September 1992.

Environmental Protection Agency, Region 10, 1992. Authorization to Discharge Under the National Pollution Discharge Elimination System; Permit No. AS0000027, Issued to VCS Samoa packing Company, 24 September 1992.

Environmental Protection Agency, Region 10, 1992. Modification of Receiving Water Qaulity Monitoring Requirements of NPDES Permit AS000019 for StarKist Samoa, Inc. and NPDES Permit AS0000027 for VCS Samoa Packing Company. November 8, 1995.

Sea-Bird Electronics, Inc., 1993. CDT Data Acquisition Software: SEASOFT, Version 4.026. Bellevue, WA, May 1993.

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Appendix I

USEPA Permit Modification for Receiving Water Quality Monitoring

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

NOV 08 1995

Norman Wei
Corporate Environmental Manager
StarKist Foods, Inc.
1054 Ways Street
Terminal Island, CA 90731

James L. Cox
Director of Engineering
and Environmental Affairs
Van Camp Seafood Company, Inc.
4510 Executive Drive, Suite 300
San Diego, CA 92121-3029

Subject: Modification of Receiving Water Quality Monitoring Requirements of NPDES Permit AS0000019 for StarKist Samoa, Inc. and NPDES Permit AS0000027 for VCS Samoa Packing Company

Dear Mr. Wei and Mr. Cox:

The U.S. Environmental Protection Agency (EPA) Region IX is modifying the receiving water quality monitoring program for the above-referenced National Pollutant Discharge Elimination System (NPDES) Permits AS0000019 and AS0000027, as per 40 CFR 122, effective November 10, 1995. Based on review of the water quality data collected under this permit, it appears that the American Samoa water quality standards for constituents monitored under the NPDES permits for the canneries are generally being met throughout Pago Pago Harbor, except in the inner harbor and ocassionally in the zone of mixing for the joint cannery outfall. It is surmised that the inner harbor exceedances may not be attributable to the canneries' discharge and the revised monitoring program will provide data to better define the causes for any noncompliance with water quality standards.

This modification to the receiving water quality monitoring program is considered a minor modification as the overall monitoring effort required is not being reduced. The purpose of the original monthly monitoring program was to assess the short-term effects of the canneries' discharge at the new outfall location. Over the past three years, sufficient data has been collected and reviewed for this purpose. The monitoring program is now being revised to assess the long-term effects of the discharge to the harbor. Changes are being made in monitoring frequency (from monthly to semi-annually to cover both oceanographic seasons), and in sampling types (from grab to continuous vertical profiles) for some parameters. Three new sampling stations are being required as well as monitoring for two additional parameters (zinc and copper) at certain stations.

Additional sampling for zinc and copper is being required to establish ambient background levels in the harbor which will be used to determine the applicability of establishing mixing zones for these constituents. Elevated zinc and copper effluent levels have been noted and significant reductions in source loadings would be very difficult, for reasons cited in the "Metals Source Identification Study for Samoa Packing", dated June 15, 1995.

The changes to the receiving water monitoring program are detailed in the attached pages. (Shaded text indicates additions to the permit. Lined out items are deletions.) These replace the corresponding pages in the permit and are hereby incorporated into and made a part of both Permits AS0000019 and AS0000027. In summary, the changes are as follows:

1. The frequency of sampling is reduced from monthly to semi-annually (corresponding with other sampling events required by the permit: effluent priority pollutant, toxicity and sediment monitoring);

2. The number of sampling stations is increased by three, from 17 to 20, and will be located as follows: on the western side of the middle harbor (American Samoa Power Authority Station B), outer harbor (new Station 6A), and transition zone (new Station 5A).

3. Continuous vertical profiles will be performed, rather than discrete samples, for temperature, salinity (conductivity), dissolved oxygen, pH, and turbidity.

4. Six, rather than three samples will be taken per station where possible, for nutrients and chlorophyll-a. Three samples will be taken at depths currently specified (near surface, 60 feet and near bottom), and three additional samples will be taken at 30, 90 and 120 feet. A minimum of three samples will be taken at each station (near surface, mid-depth and near bottom).

5. Suspended solids is removed from the suite of constituents to be analyzed.

6. Sampling for zinc and copper will be required and conducted at the same frequency as for the revised water quality monitoring program (approximately every six months). Sampling locations will be at the boundary of the existing mixing zone established for total nitrogen and total phosphorus, in the transition zone and in the inner harbor. Stations and depths to be sampled are as follows:

Stations	Depths
15, 16, 18, 5, 5A	30 ft., 120 ft., near bottom
11, 13	near surface, near bottom

The number of stations and samples may be adjusted based on the results of the first sampling episode.

7. A standard operating procedure and study plan for the revised water quality monitoring program will be developed and submitted within 30 days of the effective date of this revision for approval.

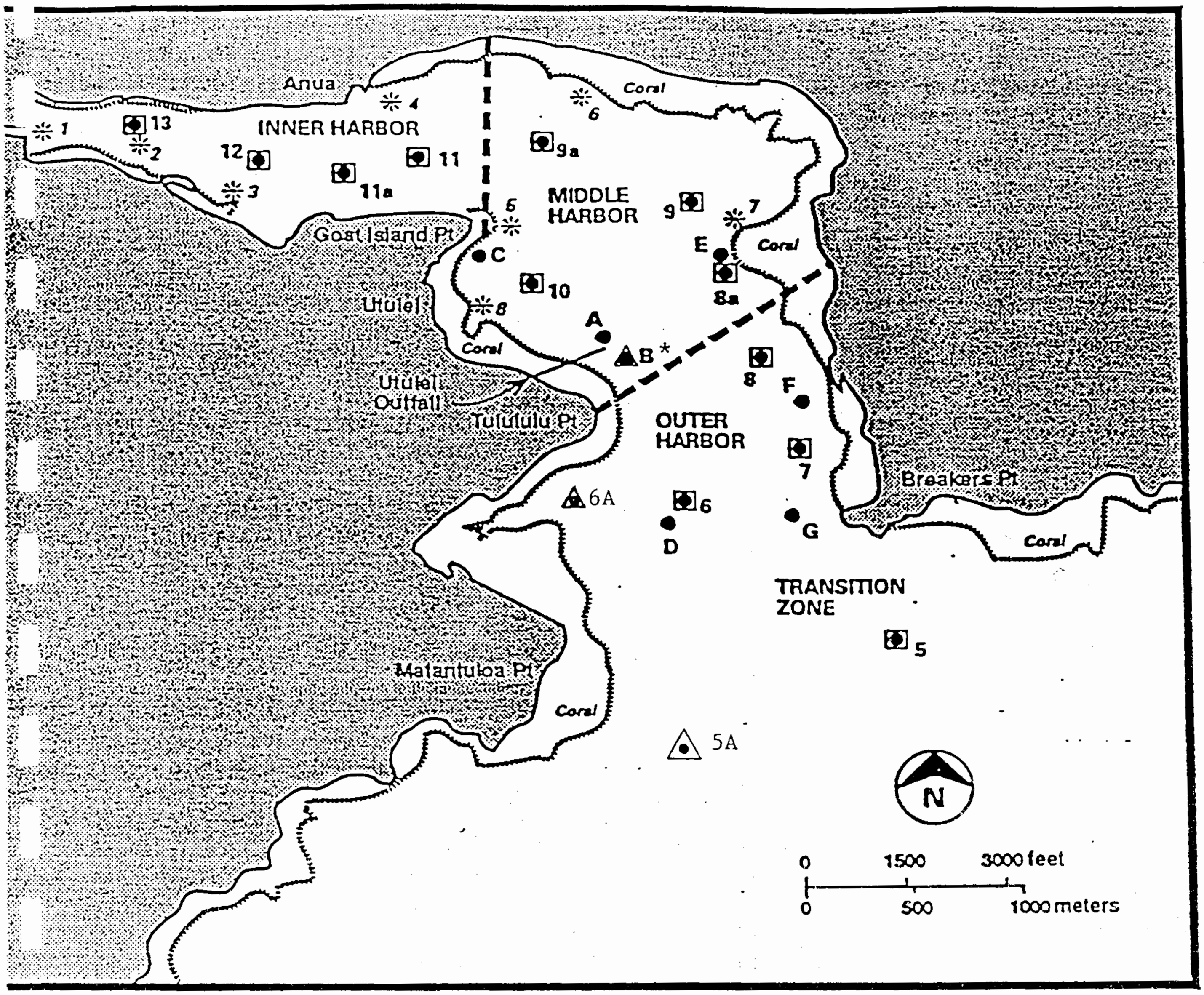
A copy of this letter and the revised pages of the permit should be attached to the current NPDES permit and kept at the respective facility's file for compliance purposes. Should you have any questions regarding this action, please call Pat Young, American Samoa Program Manager at (415) 744-1594 or Doug Liden of my staff at (415) 744-1920.

Sincerely,

Terry Oda
Chief, Permits Section
Water Management Division

Enclosures

cc: Steve Costa, CH2M HILL
Togipa Tausaga/Sheila Wiegman, ASEPA
Barry Mills, StarKist Samoa, Inc.
William D. Perez, VCS Samoa Packing Company



LEGEND

ASG Sampling Station

Utulei WWTP Station

CH2M HILL Field Measurement Station (1/19/91)

New sampling station as per permit modifications, effective 11/10/95.

* ASPA Station B will be utilized and referred to as Station 10A.

REVISED **FIGURE 2. LOCATION OF WATER QUALITY STATIONS IN PAGO PAGO HARBOR**

Monitoring stations shall be designated and located as shown (also see Figures 1 and 2-revised):

Offshore Station	Vicinity	Location	Coordinates: ~~Latitude~~ West Longitude	Coordinates: ~~Longitude~~ South Latitude
5	Transition Zone		170° 39' 44.282" ~~.72W~~	14° 17' 53.468" ~~.88S~~
5A	Transition Zone	West	170° 40' 13.000"	14° 18' 29.000"
6	Outer harbor	Central	170° 40' 11.372" ~~.20W~~	14° 17' 31.322" ~~.52S~~
6A	Outer harbor	West	170° 40' 18.500"	14° 17' 31.000"
7	Outer harbor	East, S.	170° 39' 56.256" ~~.93W~~	14° 17' 22.339" ~~.37S~~
8	Outer harbor	East	170° 39' 53.960" ~~40'.07W~~	14° 17' 10.830" ~~.17S~~
8a	Middle harbor	East	170° 40' 5.529" ~~.13W~~	14° 16' 51.575" ~~.88S~~
9	Middle harbor	East	170° 40' 9.006" ~~.18W~~	14° 16' 39.561" ~~.66S~~
9a	Middle harbor	East	170° 40' 34.862" ~~.57W~~	14° 16' 34.905" ~~.58S~~
10	Middle harbor	West	170° 40' 39.508" ~~.75W~~	14° 16' 55.258" ~~.87S~~
10A	Middle harbor	West	170° 40' 20.000"	14° 17' 10.000"
11	Inner harbor	Center, E.	170° 40' 54.092" ~~.90W~~	14° 16' 34.295" ~~.58S~~
11a	Inner harbor	Center, E.	170° 41' 6.540" ~~.13W~~	14° 16' 38.573" ~~.62S~~
12	Inner harbor	Center	170° 41' 20.769" ~~.33W~~	14° 16' 36.564" ~~.60S~~
13	Inner harbor	Center, W.	170° 41' 42.849" ~~.71W~~	14° 16' 30.008" ~~.50S~~
14	Middle harbor	Diffuser	170° 40' 1.678" ~~.03W~~	14° 16' 58.934" ~~.58S~~
15	Middle harbor	ZOM Edge, N.	170° 40' 6.243" ~~.12W~~	14° 16' 45.692" ~~.77S~~
16	Middle harbor	ZOM Edge, W.	170° 40' 13.483" ~~.17W~~	14° 16' 57.273" ~~.56S~~
17	Middle harbor	ZOM Edge, E.	170° 40' 1.158" ~~39'.91W~~	14° 16' 54.398" ~~.90S~~
18	Outer harbor	ZOM Edge, S.	170° 39' 59.177" ~~40'.08W~~	14° 17' 8.862" ~~.10S~~

Note: Revised coordinates listed are locations of stations used and reported in CH2M Hill's July 7, 1995 Report, "Results of March 1995 Harbor Water Quality Monitoring Pago Pago Harbor, American Samoa", and are as read from GPS in field. (A correction factor based on readings at known locations may be required for exact station location.) Latitudes for Stations 14 and 16 originally listed in the permit were incorrect and are corrected here.

It is recommended that the stations be located using the sextant angle resection positioning method or a positioning system which affords an equivalent degree of accuracy and precision. Other means may be used if, in the judgment of ASEPA and EPA Region 9, they are of sufficient accuracy and precision to allow reoccupation of the stations within plus or minus six (6) meters.

The following shall constitute the Water Quality Monitoring Program as shown:

Parameter	Units	Stations	Sample Type		Sample Frequency	
Temperature	°F	all	~~grab~~	continuous(1)	~~monthly~~	semi-annual(2)
pH		"	~~"~~	continuous(1)	~~"~~	semi-annual(2)
Dissolved Oxygen	mg/l	"	~~"~~	continuous(1)	~~"~~	semi-annual(2)
~~Suspended Solids~~	~~mg/l~~	~~"~~	~~"~~		~~"~~	
Light Penetration	ft.	"	grab		~~"~~	semi-annual(2)
Turbidity	NTU	"	~~"~~	continuous(1)	~~"~~	semi-annual(2)
Salinity	ppt	"	~~"~~	continuous(1)	~~"~~	semi-annual(2)
Chlorophyll a (3)	µg/l	"	grab		~~"~~	semi-annual(2)
Total Nitrogen (3)	µg/l	"	"		"	semi-annual(2)
Total Phosphorus (3)	µg/l	"	"		~~"~~	semi-annual(2)
Total Ammonia (3)	µg/l	"	"		~~"~~	semi-annual(2)
Zinc	µg/l	(4)	"			semi-annual(2)
Copper	µg/l	(4)	"			semi-annual(2)

(1) Continuous vertical profiles.

(2) Sampling to occur approximately every 6 months to coincide with the two main oceanographic seasons.

(3) Samples to be taken at the following depths where possible: near surface, 30, 60, 90 and 120 feet, and near bottom. Where water depth is less than 120 feet, a minimum of three samples shall be taken at each station (near surface, mid-depth and near bottom).

(4) The following stations shall be sampled at the noted depths:
Stations 5, 5A, 15, 16 18: 30 feet, 120 feet, near bottom;
Stations 11 and 13: near surface and near bottom.
The number of stations and samples may be adjusted based on the results of the first sampling episode, upon approval by USEPA and ASEPA.

~~Measurements should be taken at three depths for each location: 1 meter above the bottom, 1 meter below the surface, and at mid-depth.~~

A study plan which includes standard operating procedures for receiving water quality measurements will be developed and submitted to ASEPA and USEPA for approval within 30 days of the effective date of this revision.

Monitoring stations shall be designated and located as shown (also see Figures 1 and 2-revised):

Offshore Station	Vicinity	Location	Coordinates ~~Latitude~~ West Longitude		~~Longitude~~ South Latitude	
5	Transition Zone		170° 39' 44.282"	~~.72W~~	14° 17' 53.468"	~~.88S~~
5A	Transition Zone	West	170° 40' 13.000"		14° 18' 29.000"	
6	Outer harbor	Central	170° 40' 11.372"	~~.20W~~	14° 17' 31.322"	~~.52S~~
6A	Outer harbor	West	170° 40' 18.500"		14° 17' 31.000"	
7	Outer harbor	East, S.	170° 39' 56.256"	~~.93W~~	14° 17' 22.339"	~~.37S~~
8	Outer harbor	East	170° 39' 53.960"	~~40'.07W~~	14° 17' 10.830"	~~.17S~~
8a	Middle harbor	East	170° 40' 5.529"	~~.13W~~	14° 16' 51.575"	~~.88S~~
9	Middle harbor	East	170° 40' 9.006"	~~.18W~~	14° 16' 39.561"	~~.66S~~
9a	Middle harbor	East	170° 40' 34.862"	~~.57W~~	14° 16' 34.905"	~~.58S~~
10	Middle harbor	West	170° 40' 39.508"	~~.75W~~	14° 16' 55.258"	~~.87S~~
10A	Middle harbor	West	170° 40' 20.000"		14° 17' 10.000"	
11	Inner harbor	Center, E.	170° 40' 54.092"	~~.90W~~	14° 16' 34.295"	~~.58S~~
11a	Inner harbor	Center, E.	170° 41' 6.540"	~~.13W~~	14° 16' 38.573"	~~.62S~~
12	Inner harbor	Center	170° 41' 20.769"	~~.33W~~	14° 16' 36.564"	~~.60S~~
13	Inner harbor	Center, W.	170° 41' 42.849"	~~.71W~~	14° 16' 30.008"	~~.50S~~
14	Middle harbor	Diffuser	170° 40' 1.678"	~~.03W~~	14° 16' 58.934"	~~.58S~~
15	Middle harbor	ZOM Edge, N.	170° 40' 6.243"	~~.12W~~	14° 16' 45.692"	~~.77S~~
16	Middle harbor	ZOM Edge, W.	170° 40' 13.483"	~~.17W~~	14° 16' 57.273"	~~.56S~~
17	Middle harbor	ZOM Edge, E.	170° 40' 1.158"	~~39'.91W~~	14° 16' 54.398"	~~.90S~~
18	Outer harbor	ZOM Edge, S.	170° 39' 59.177"	~~40'.08W~~	14° 17' 8.862"	~~.10S~~

Note: Revised coordinates listed are locations of stations used and reported in CH2M Hill's July 7, 1995 Report, "Results of March 1995 Harbor Water Quality Monitoring Pago Pago Harbor, American Samoa", and are as read from GPS in field. (A correction factor based on readings at known locations may be required for exact station location.) Latitudes for Stations 14 and 16 originally listed in the permit were incorrect and are corrected here.

It is recommended that the stations be located using the sextant angle resection positioning method or a positioning system which affords an equivalent degree of accuracy and precision. Other means may be used if, in the judgment of ASEPA and EPA Region 9, they are of sufficient accuracy and precision to allow reoccupation of the stations within plus or minus six (6) meters.

The following shall constitute the Water Quality Monitoring Program as shown:

Parameter	Units	Stations	Sample Type		Sample Frequency	
Temperature	°F	all	~~grab~~	continuous(1)	~~monthly~~	semi-annual(2)
pH		"	"	continuous(1)	"	semi-annual(2)
Dissolved Oxygen	mg/l	"	"	continuous(1)	"	semi-annual(2)
~~Suspended Solids~~	~~mg/l~~	~~"~~	~~"~~		~~"~~	
Light Penetration	ft.	"	grab		"	semi-annual(2)
Turbidity	NTU	"	"	continuous(1)	"	semi-annual(2)
Salinity	ppt	"	"	continuous(1)	"	semi-annual(2)
Chlorophyll a (3)	µg/l	"	grab		"	semi-annual(2)
Total Nitrogen (3)	µg/l	"	"		"	semi-annual(2)
Total Phosphorus (3)	µg/l	"	"		"	semi-annual(2)
Total Ammonia (3)	µg/l	"	"		"	semi-annual(2)
Zinc	µg/l	(4)	"			semi-annual(2)
Copper	µg/l	(4)	"			semi-annual(2)

(1) Continuous vertical profiles.

(2) Sampling to occur approximately every 6 months to coincide with the two main oceanographic seasons.

(3) Samples to be taken at the following depths where possible: near surface, 30, 60, 90 and 120 feet, and near bottom. Where water depth is less than 120 feet, a minimum of three samples shall be taken at each station (near surface, mid-depth and near bottom).

(4) The following stations shall be sampled at the noted depths:
Stations 5, 5A, 15, 16 18: 30 feet, 120 feet, near bottom;
Stations 11 and 13: near surface and near bottom.
The number of stations and samples may be adjusted based on the results of the first sampling episode, upon approval by USEPA and ASEPA.

~~Measurements should be taken at three depths for each location: 1 meter above the bottom, 1 meter below the surface, and at mid-depth.~~

A study plan which includes standard operating procedures for receiving water quality measurements will be developed and submitted to ASEPA and USEPA for approval within 30 days of the effective date of this revision.

Appendix II

Combined Sampling and Analysis Plan and Standard Operating Procedures

Plan of Study
for
Receiving Water Quality Sampling
Pago Pago Harbor, American Samoa

A Combined
Sampling and Analysis Plan
and
Standard Operating Procedures

Prepared for

StarKist Samoa (NPDES Permit AS0000019)
and
VCS Samoa Packing (NPDES Permit AS0000027)

Submitted to

United States Environmental Protection Agency
and
American Samoa Environmental Protection Agency

Prepared by

CH2M HILL

2 March 1996 : Revision 1

Purpose

On 8 November 1995 the U.S. Environmental Protection Agency issued a modification to the receiving water quality monitoring requirements of the NPDES permits issued to StarKist Samoa and VCS Samoa Packing. This combined sampling and analysis plan and standard operating procedures (SAP/SOP) has been prepared in compliance with the permits and to maintain a consistent and acceptable quality of data for the monitoring program.

Scope

The data collection and sampling requirements of the permits are listed in this document, including that supporting or ancillary data not directly referenced in the permit but of value in interpreting results. The SAP/SOP also addresses the sample location and navigation methods to be used and the specific methods to be used to take field measurements and collect, process, store and ship sea water samples. Quality assurance and quality control (QA/QC) and reporting format are also discussed. It is assumed that the field team will be familiar with the types of oceanographic equipment to be used and detailed instructions for the correct use of such equipment is generally not discussed.

Data and Samples Description

The permit requires the in-field measurement of the following variables as continuous vertical profiles: temperature, pH, dissolved oxygen (DO), turbidity, and salinity. In addition a measurement of light penetration is required. The permit also requires the collection of samples for laboratory analysis of chlorophyll-a, total nitrogen, total phosphorous, and total ammonia at all stations. In addition, analyses for zinc and copper are required at selected stations. In support of the primary data collection and sampling the following information will be recorded at each location at the time of sampling and data collection: date, time, personnel present, total water depth, and general meteorological conditions including wind speed and direction, sea state, precipitation condition, and cloud cover.

Sampling Locations and Times

Sampling is to be done twice a year during the two main oceanographic seasons. The two oceanographic seasons are the tradewind and non-tradewind seasons, which a re separated by short transition periods. Other studies being conducted under the permit are also aligned with these seasons. Sampling will normally be scheduled for the February-March and August-September-October time periods.

Sampling and data measurement locations consist of twenty (20) stations located throughout Pago Pago harbor and described by latitude and longitude and graphically in the permit and permit modification. At each station location continuous vertical profiles will be taken, other data as described above will be recorded, and samples will be collected at the following depths: near surface, 30 feet, 60 feet, 90 feet, 120 feet, and near bottom. Where water depth is less than 120 feet samples will be collected at three depths including: near surface mid-depth, and near bottom. The sample collection for metals is abbreviated and samples will be collected at three depths (30 feet, 120 feet, and near bottom) at five (5) stations and at surface and near bottom at two stations. The stations for metals sampling are specified in the permit modification.

Station locations are specified in the permit both by latitude and longitude and graphically. Problems have been encountered previously in correlating the latitude-longitude coordinates with known or charted positions in Pago Pago Harbor. There are at least three datums in use in various references: Preliminary NAD (North American Datum) 1927, NAD 1927, and NAD 1983 which essentially corresponds to WGS (World Geodetic System) 1984 as typically used in satellite navigation systems and global positioning systems (GPS). Therefore, latitudes and longitudes derived from different sources can be significantly different for the same point or feature on the ground. The procedure described below will be used to avoid confusion in the future.

GPS positioning will be used for station locations. During the first data collection episode We will recorded, and permanently store, the WGS coordinates of the stations actually occupied for this sampling and will use the same coordinates for all future sampling episodes. Since differential GPS is not yet available in American Samoa one of two methods will be used for station location: installation of a base unit at a known bench mark or, during each sampling two known bench marks will be visited and the appropriate corrections will be recorded and applied to determine the station location. These methods should provide sufficient accuracy for water quality sampling (the occupation at two benchmarks will also provide an estimate of precision).

Sample Collection

Water samples will be collected from each depth specified in the permit using a Niskin type sampling bottle. Following the determination of total water depth as described below, the collection bottle will be lowered to the appropriate depth using a measured line and allowed to hang for a minimum of 1 minute. The bottle will then be triggered by a messenger dropped down the line and the bottle retrieved. Sample bottles, as described in Table 1 will be immediately filled and preserved as indicated in the table, stored on ice, and prepared for shipment to the laboratory. In addition, a minimum of two liters will be collected and stored on ice for chlorophyll-a filtering and analysis. The chlorophyll samples will be filtered through a Whatman grade GF/F glass microfiber filter paper (0.7 micron) using a vacuum pump apparatus within twenty four hours of sample collection. The filters will be treated with manganese sulfate as a preservative and then stored in a freezer until sent to the laboratory for analysis.

Parameter Measurements

As described above, in addition to the required continuous vertical profiles, the following information will be recorded at each location at the time of sampling and at the time of profile collection (if different): date, time, personnel present, total water depth, and general meteorological conditions including wind speed and direction, sea state, precipitation condition, and cloud cover. The continuous profiles may be taken at the same time or at different times from the sample collection. If the profiling is done at a different time, the same information listed above will be recorded. Also a measure of light penetration, as described by Secchi depth will be collected at each station either during the time of sample collection or vertical profiling. The various parameters will be measured as follows:

- Water depth will be measured using a non-recording portable fathometer or a measured and marked lead line
- Secchi depth will be determined by using a standard size and patterned Secchi disk lowered through the water column on a measured line
- Wind speed and direction will be estimated using a small hand held anemometer and compass
- Other meteorological parameters will be visually estimated

Conductivity, temperature, depth (pressure), DO, pH, and turbidity will be measured using an internally recording profiling instrument which has been calibrated by the manufacturer prior to shipment to American Samoa. Salinity and sea water density will be calculated from conductivity and temperature using the manufactures supplied software or other appropriate formulations. Backup instruments for all parameters will be available in case of failure of any or all of the profiling sensors. In such a case measurements will be taken using the individual grab samples.

Sample Handling

The general procedure for handling samples is outlined below. Note that special procedures for the chlorophyll-a samples are discussed above. In the field, sample collection should use the following procedure:

- Label the individual grab sample containers as listed in Table 1 with an appropriate and unique sample identifier and date and time, bottles should be pre-labeled prior to sample collection in the field
- Fill the bottles to the top, and cover the container securely with its lid.
- Store all samples in coolers on ice at a temperature of approximately 4 °C until packaging for shipment to the laboratory.

One chain-of-custody form is required for each cooler of samples that will be shipped. Sample identification on the chain-of-custody should match the labels on the sample containers exactly. Any multiple samples or backup samples must be appropriately indicated on the chain of custody form. The methods requested should be shown on the chain of custody form. Also, note on the chain of custody form that samples are sea water.

Prior to shipping, acid preserved samples should be checked for pH and the pH should be adjusted as necessary to meet the requirements listed in Table 1. Each glass sample bottle should be wrapped in bubble-wrap or an equivalent packaging material and placed in a plastic zip-lock bag. Plastic sample bottles should be placed in a plastic zip-lock bags as well. As much air as possible should be removed from the bag prior to sealing it. Too much air inside the bags will expand during the flight and pop the bag open. Place sample bottles inside the cooler. Packaging material (bubble wrap or equivalent) should be placed in the cooler to prevent bottles from moving and impacting each other.

Ice or an equivalent means (such as chemical cold packs) must be included to keep the samples cold during shipping. <u>Do not use dry ice to pack the samples</u>. If ice is used, precautions should be taken to prevent melted ice from leaking out of the cooler during shipping. These include taping any drain plugs in the cooler shut with duct tape or strapping tape, and "double-bagging" the ice cubes in zip-lock bags. As with the bags used to hold the sample bottles, as much air as possible should be removed from the bags prior to sealing.

The chain-of-custody form for each cooler should be signed, placed in a zip-lock bag, and taped with duct tape to the inside of the cooler lid. The cooler should be taped securely shut with strapping tape or other strong packaging tape to prevent it from opening during shipping.

Quality Assurance And Quality Control

The quality assurance and quality control objectives for the study are to collect physical and hydrographic data and representative samples at predetermined locations and provide field and laboratory measurements that are of known and acceptable quality. A list of field equipment is given in Table 2. The following requirements will be followed to meet the objectives:

- Maintain and document accurate positioning for sample collection
- Verify the GPS at known points near or within the study area
- Provide field equipment redundancy (backup equipment)
- Develop and use the field standard operations procedures (SOP) as described in this document
- Obtain all equipment prior to the beginning of the field collections and check to verify correct operation
- Any instrument requiring calibration will be checked and calibrated upon its arrival to confirm that it is in working condition.

- Examine samples as collected and subsequent data analysis by experienced scientists

- Provide verifiable laboratory chemical analyses with appropriate QA to evaluate accuracy and precision targets

Health and Safety Considerations

The data and sample collection and preparation should be done or directly supervised by staff that are experienced with this type of work and are fully aware of all health and safety practices that apply in such cases.

Reporting

A report of the results will be provided to USEPA and ASEPA after receipt and post processing of the results of the chemical sample analyses. Field data will be summarized and positioning data will be tabulated. Laboratory chemical data will be reviewed to determine whether analytical accuracy and precision targets were achieved and to assess the laboratory quality assurance. Chemical analyses results will be presented in tabular formats. Any proposed revisions to the study plan will be presented in the report. Review comments from USEPA and ASEPA will be incorporated into the revised study plan as appropriate.

- An introduction presenting the background, rationale, objectives and setting of the study

- A section describing the approach and methods, including any deviations or changes from the study plan, and justification for any such deviations

- A section presenting summary results of the information gathered

- A section discussing any pertinent conclusions, recommendations, and proposed changes to the study

- Appendices containing the study plan, a record of approvals of any previous changes to the study, the laboratory reports, chain of custody records, and any other pertinent information

Table 1
Pago Pago Harbor Water Quality Monitoring
Sample Analysis And Handling Procedures

ANALYTE	METHOD	REPORTING DETECTION LIMIT	SAMPLE HOLDING TIME	SAMPLE CONTAINER	SAMPLE PRESERVATION
Temperature	Field Probe	0.1°C	N/A	N/A	none
Salinity	Field Probe	0.1 PSU	N/A	N/A	none
Dissolved O_2	Field Probe	0.1 mg/l	N/A	N/A	none
pH	Field Probe	0.1 SU	N/A	N/A	none
Turbidity	Field Probe	0.2 NTU	N/A	N/A	none
Turbidity[1]	EPA 180.1	0.01 NTU	48 hours [2]	500 ml plastic	none
Nitrite Nitrogen	EPA 354.1	0.001 mg/l	48 hours [2]	2 - 500 ml plastic	4°C - H_2SO_4
Nitrate + Nitrite	EPA 353.2	0.010 mg/l	28 days		
Ammonia Nitrogen	EPA 350.1	0.005 mg/l	28 days		
Total Kheldal Nitrogen	EPA 351.3	0.025 mg/l	28 days		
Total Phosphorus	EPA 365.2	0.005 mg/l	28 days		
Chlorophyll-a	SM 1002 G	0.03 mg/m ^{3}	3 months	Whatman grade GF/F glass microfiber filter (0.7 micron)	frozen, manganese sulfate
Zinc	EPA 200.7	20 μg/l	6 months	500 ml plastic	4°C - HNO_3 to a pH of ≤ 2
Copper	EPA 220.2	2 μg/l			

Notes:
[1] Turbidity samples sent to lab from selected stations only to verify probe readings. Stations selected at discretion of filed team leader.
[2] Holding times for turbidity and nitrite nitrogen are unavoidably exceeded because of logistics involved in shipping from American Samoa. The laboratory (AMTEST) agreed to test for these constituents immediately upon receipt of the samples.

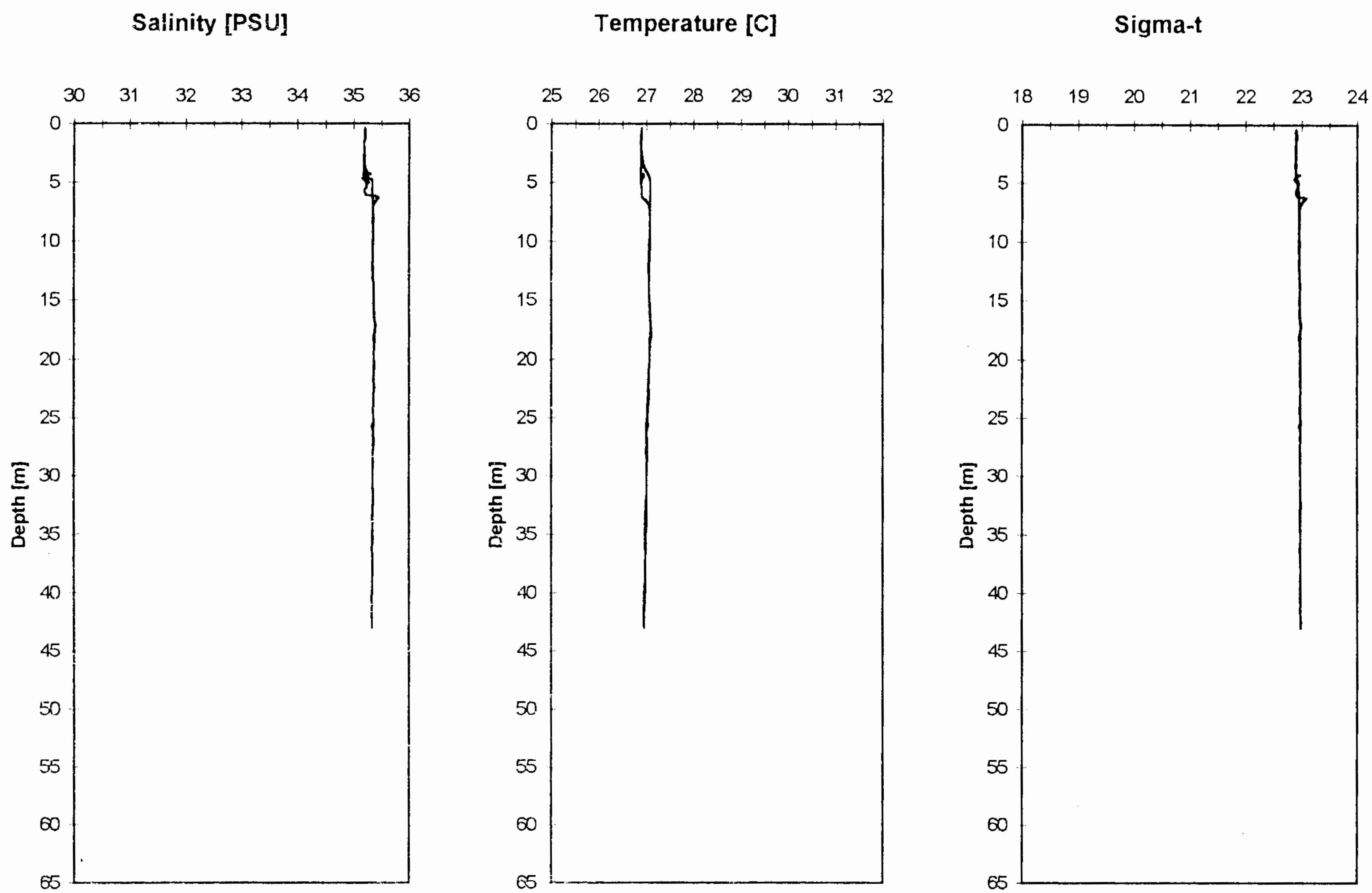
Table 2
Field Equipment for Field Data Measurement and Sample Collection

Equipment Item	Purpose	Number of Units	Accuracy Standard
Work Vessel	Serves as field sampling platform	1	N/A
GPS (or equivalent)	Station positioning system using GPS	1	± 10 meters
Tape measure and/or marked line	Establish depths at sampling locations (backup for fathometer)	1	± 1 foot
Niskin Sampling Bottles (or equivalent)	Collect water samples	2	N/A
Conductivity, Salinity, Temperature (SCT) Meter	Backup for profiling instrument	1	Temp: ± 0.2 °C Cond: ± 0.5 mS/cm Salinity: ± 0.2 PSU
pH Meter	Backup for profiling instrument		pH: ± 0.2 SU
Dissolved Oxygen meter	Backup for profiling instrument	1	DO: ± 0.2 mg/l
Profiling CTD with DO, pH, and Turbidity sensors	Record temperature, conductivity, depth	1	Temp: ± 0.1 °C Cond: ± 0.1 mS/cm Depth: ± 0.1 meter pH: ± 0.2 SU DO: ± 0.2 mg/l Turbidity: ± 0.1 NTU
Vacuum Filtering Apparatus and Filter Paper	Prepare chlorophyll samples	1	N/A
Fathometer	Measure depth at each station	1	± 1 foot
Sample Containers and Preservatives	Collection of receiving water samples for chemical analyses, including sample to be filtered for chlorophyll-a analysis	As required	Pre-cleaned sample containers
Ice Chests	Hold sample jar, cool samples on ice, and ship samples	As required	Pre-cleaned containers

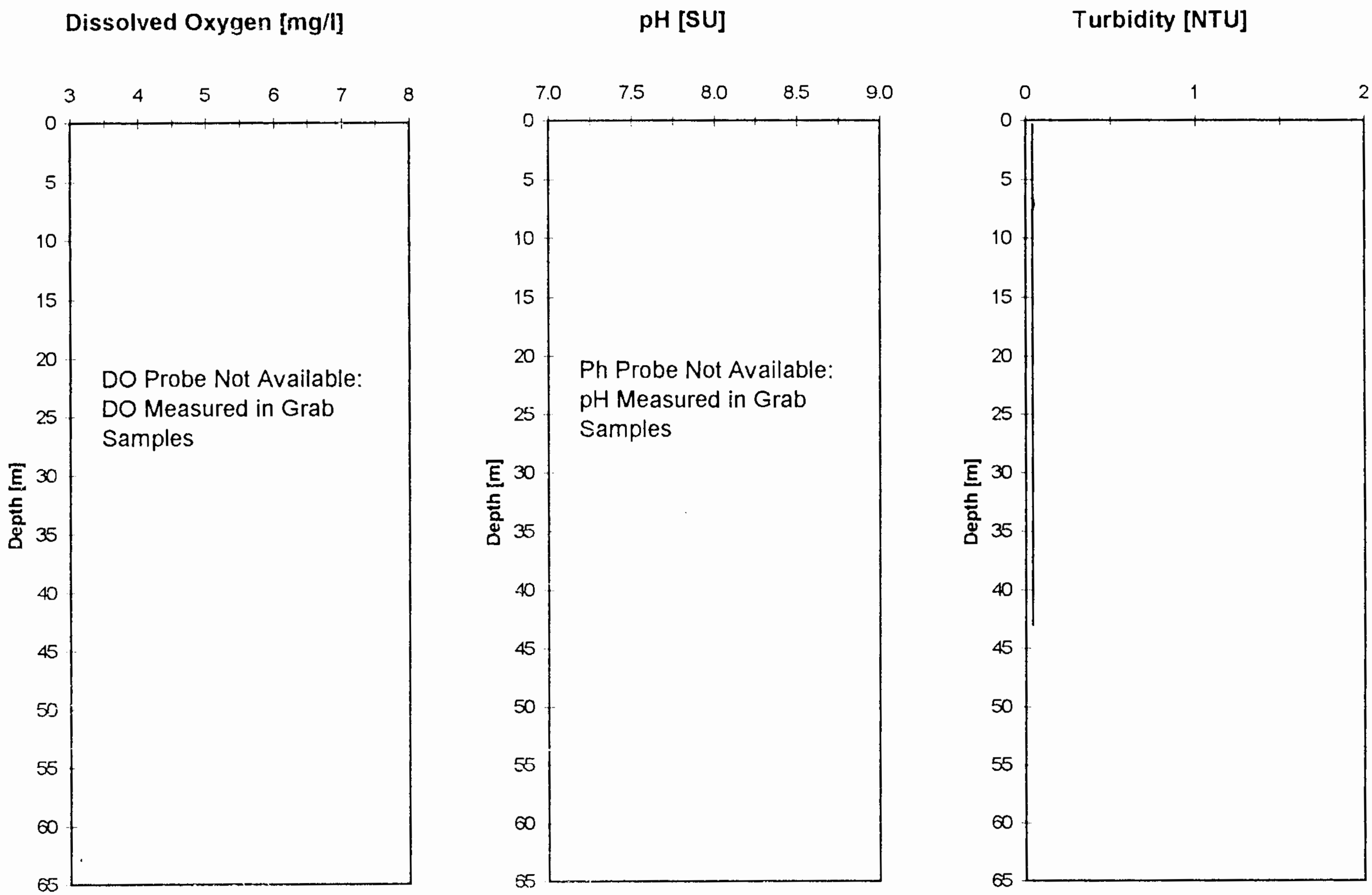
Notes: N/A = Not applicable

Appendix III

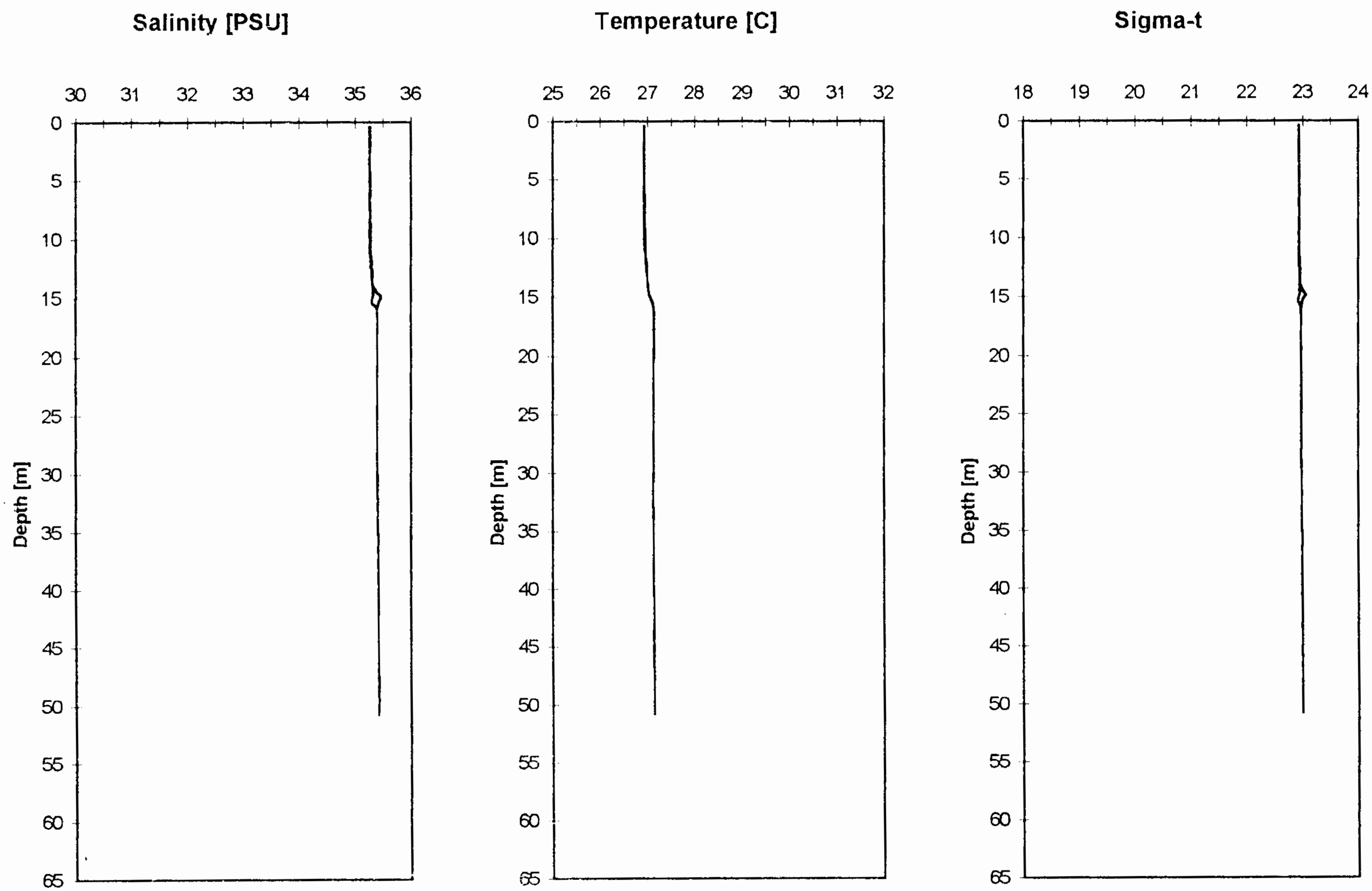
Vertical Profile Data for Each Station
4 September 1997



Station 5
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
4 September 1997



Station 5
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
4 September 1997

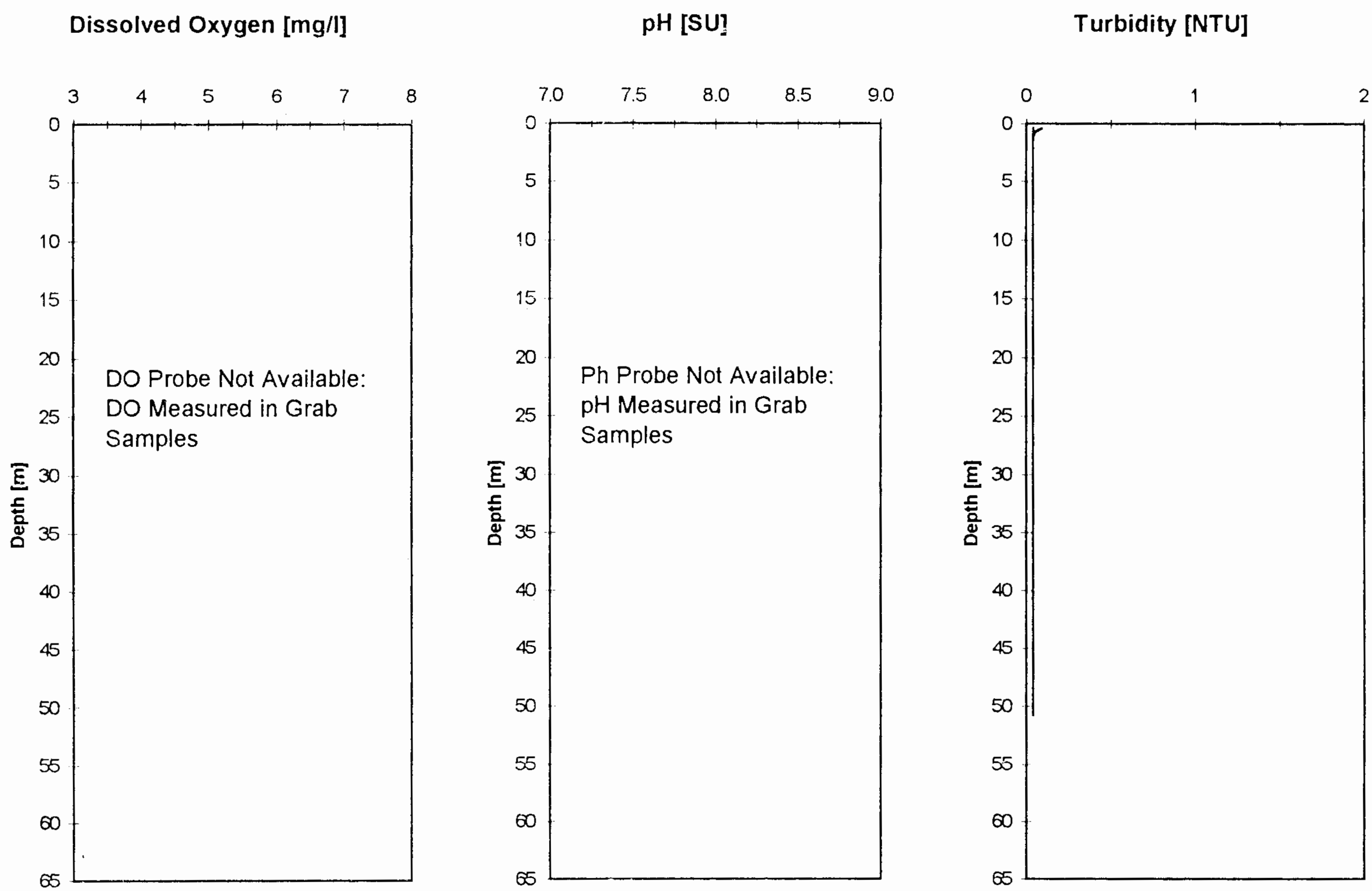


Station 5A

Pago Pago Harbor Water Quality Monitoring Profiles

Salinity, Temperature, and Density

4 September 1997



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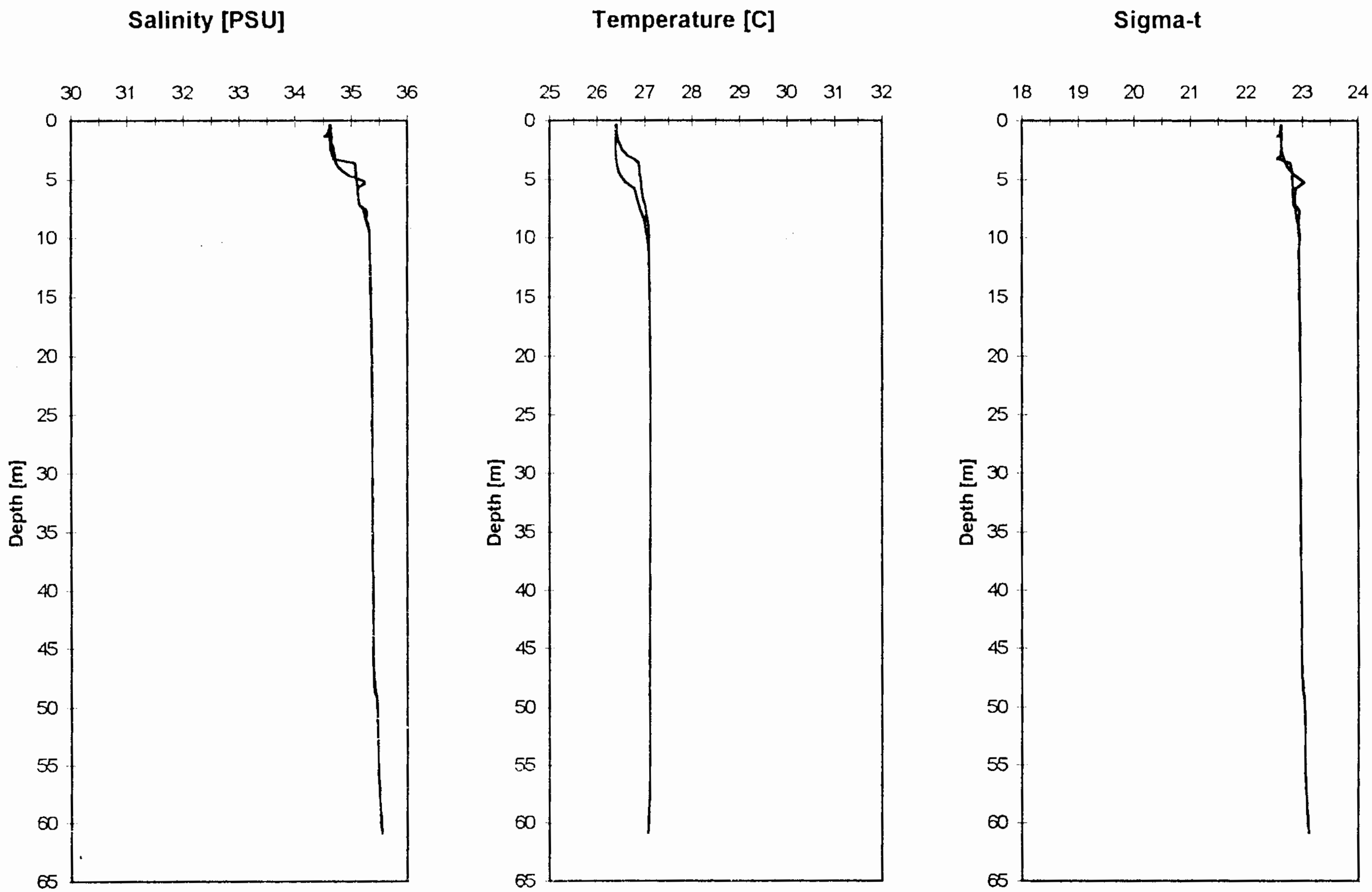
4 September 1997



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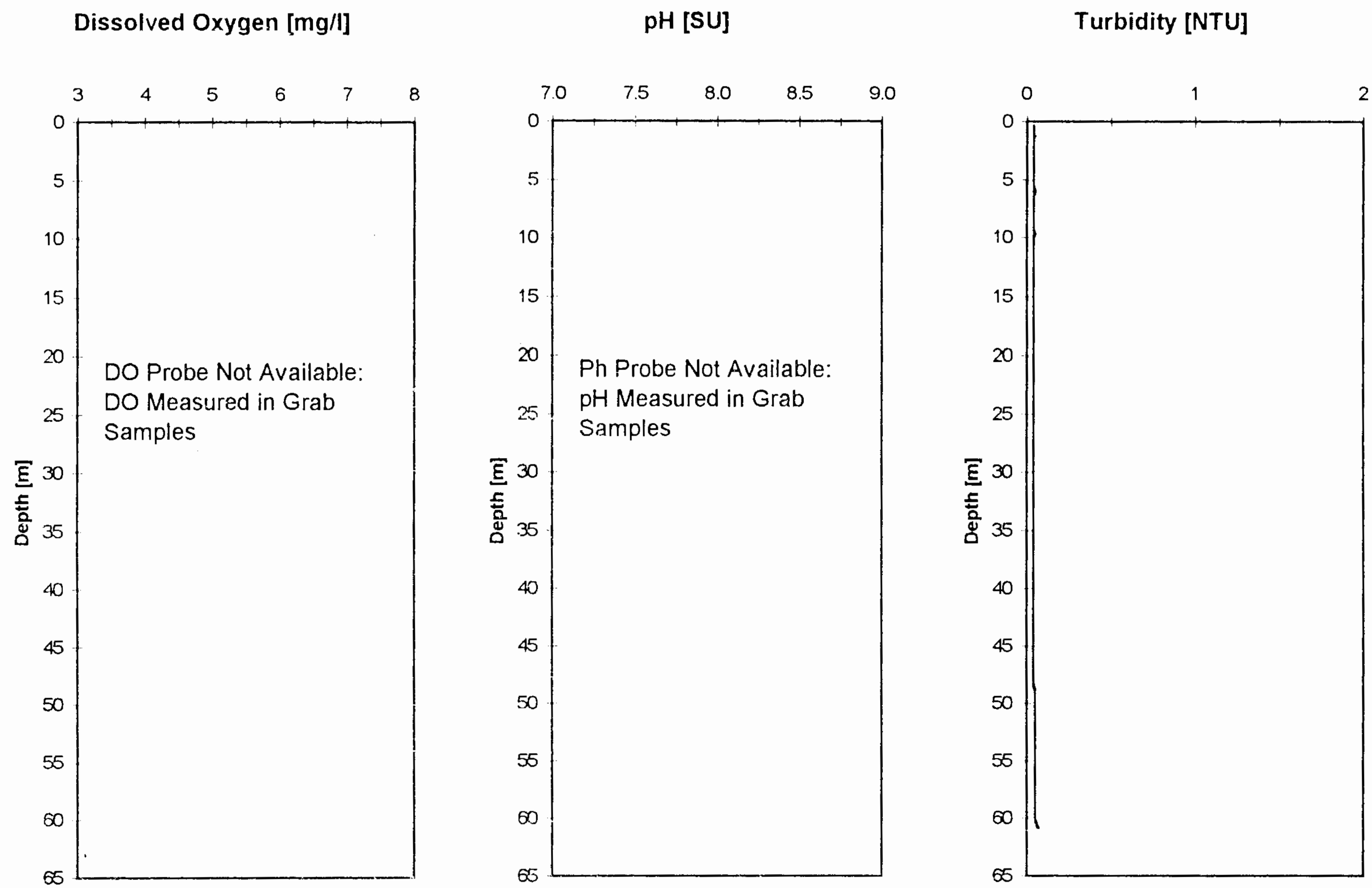
Salinity, Temperature, and Density
4 September 1997



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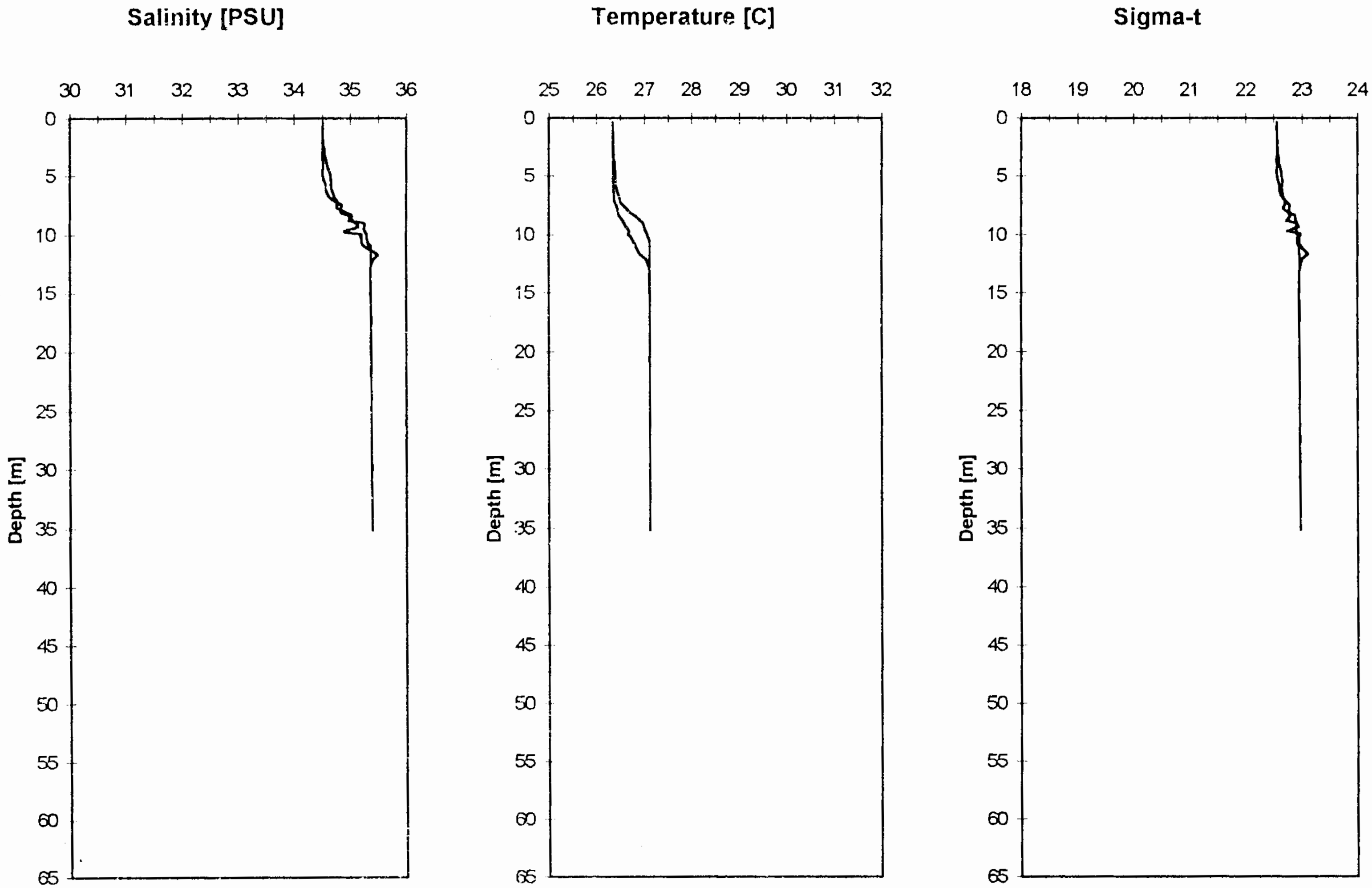
Dissolved Oxygen, pH, and Turbidity
4 September 1997

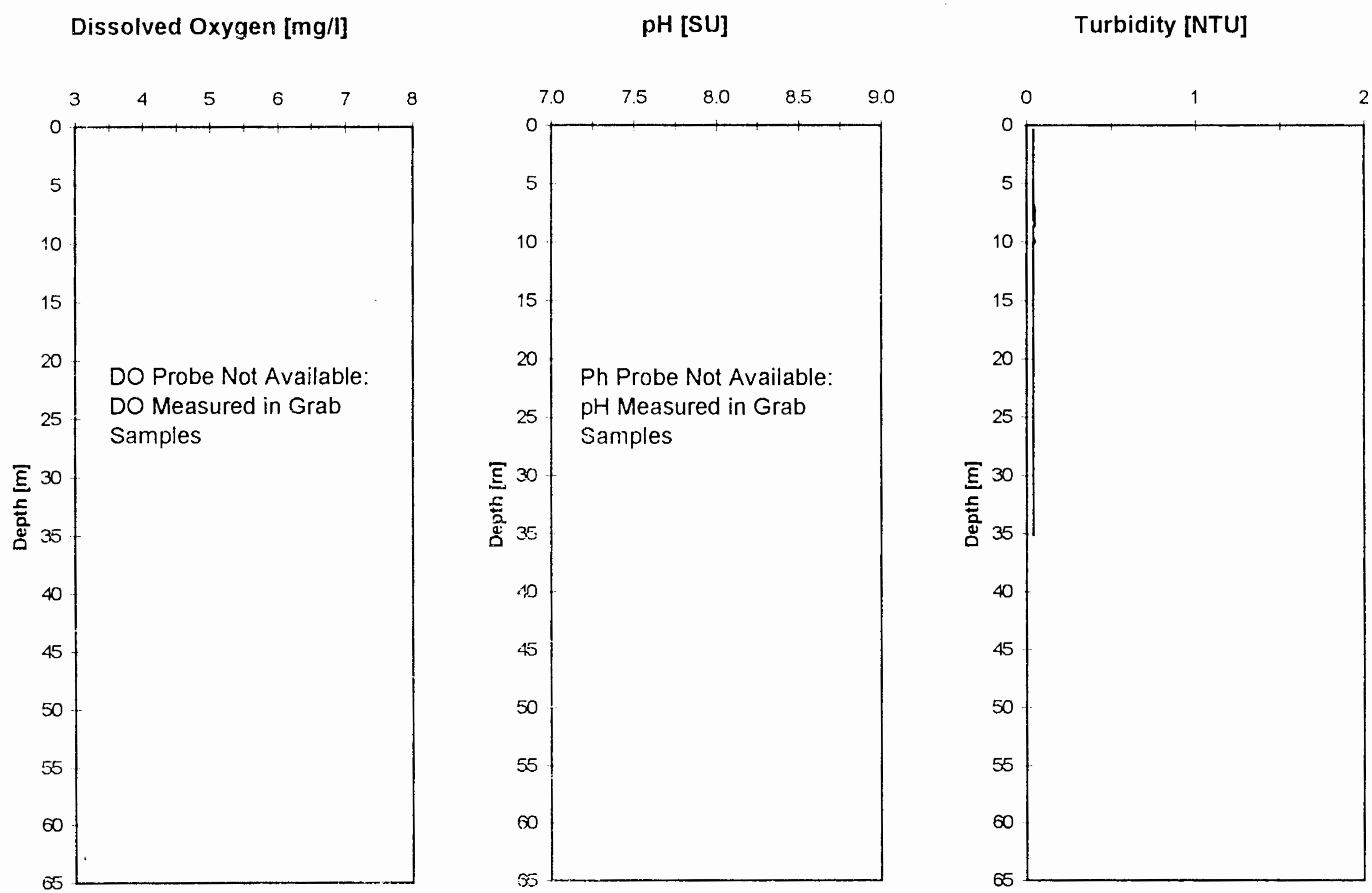


Station 6A

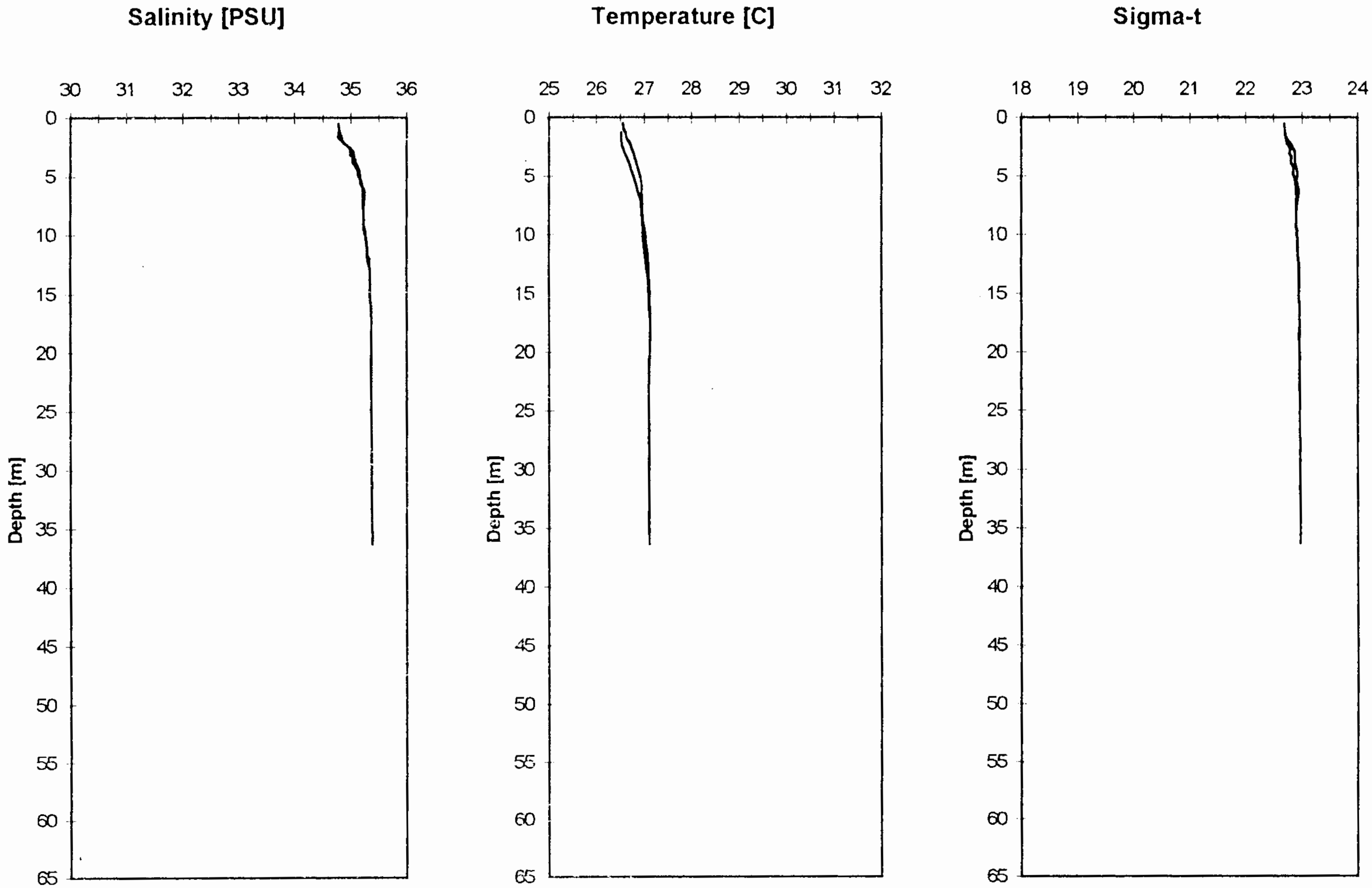
Pago Pago Harbor Water Quality Monitoring Profiles

Salinity, Temperature, and Density

4 September 1997



Station 6A
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
4 September 1997



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Salinity, Temperature, and Density
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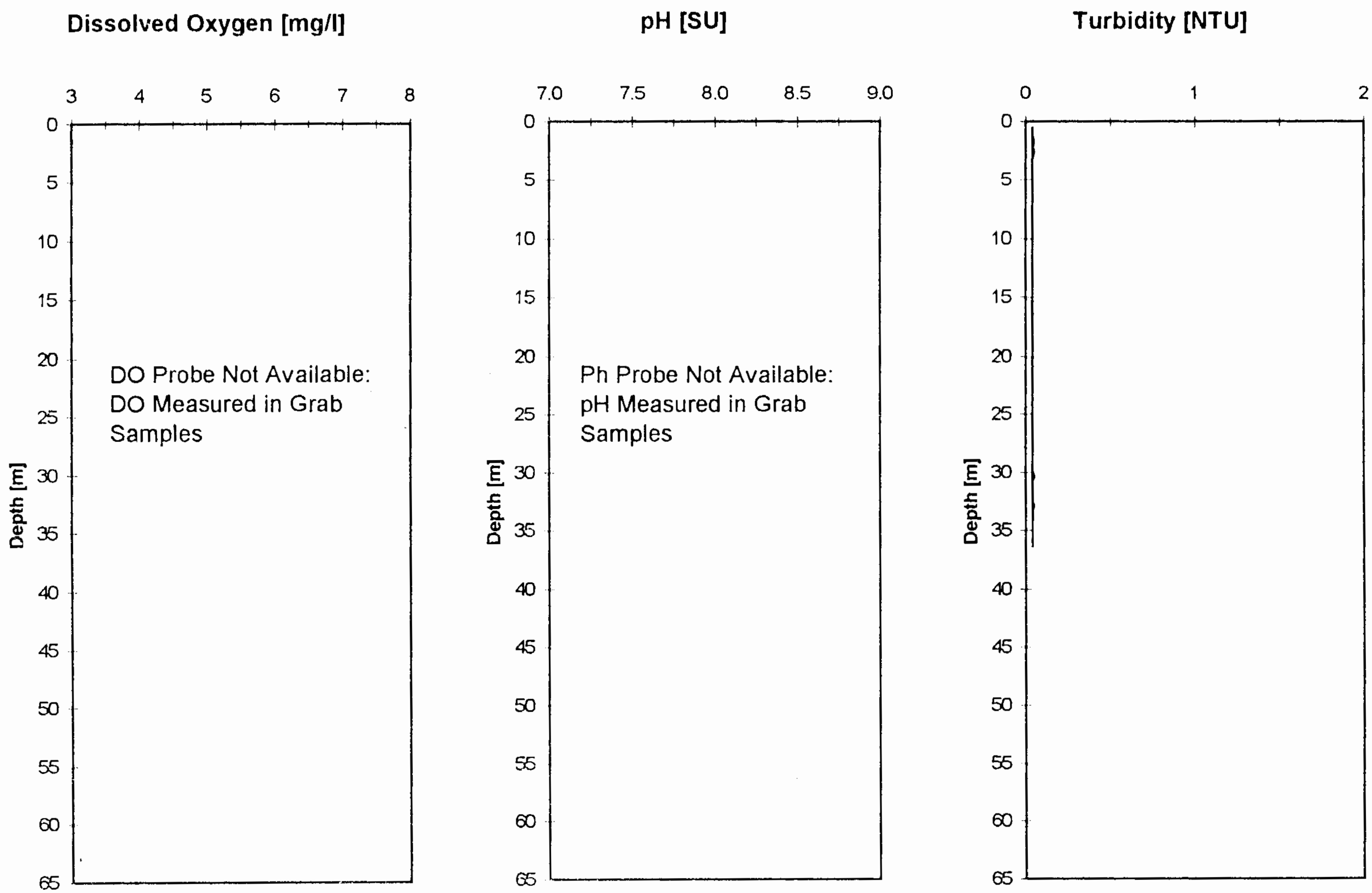

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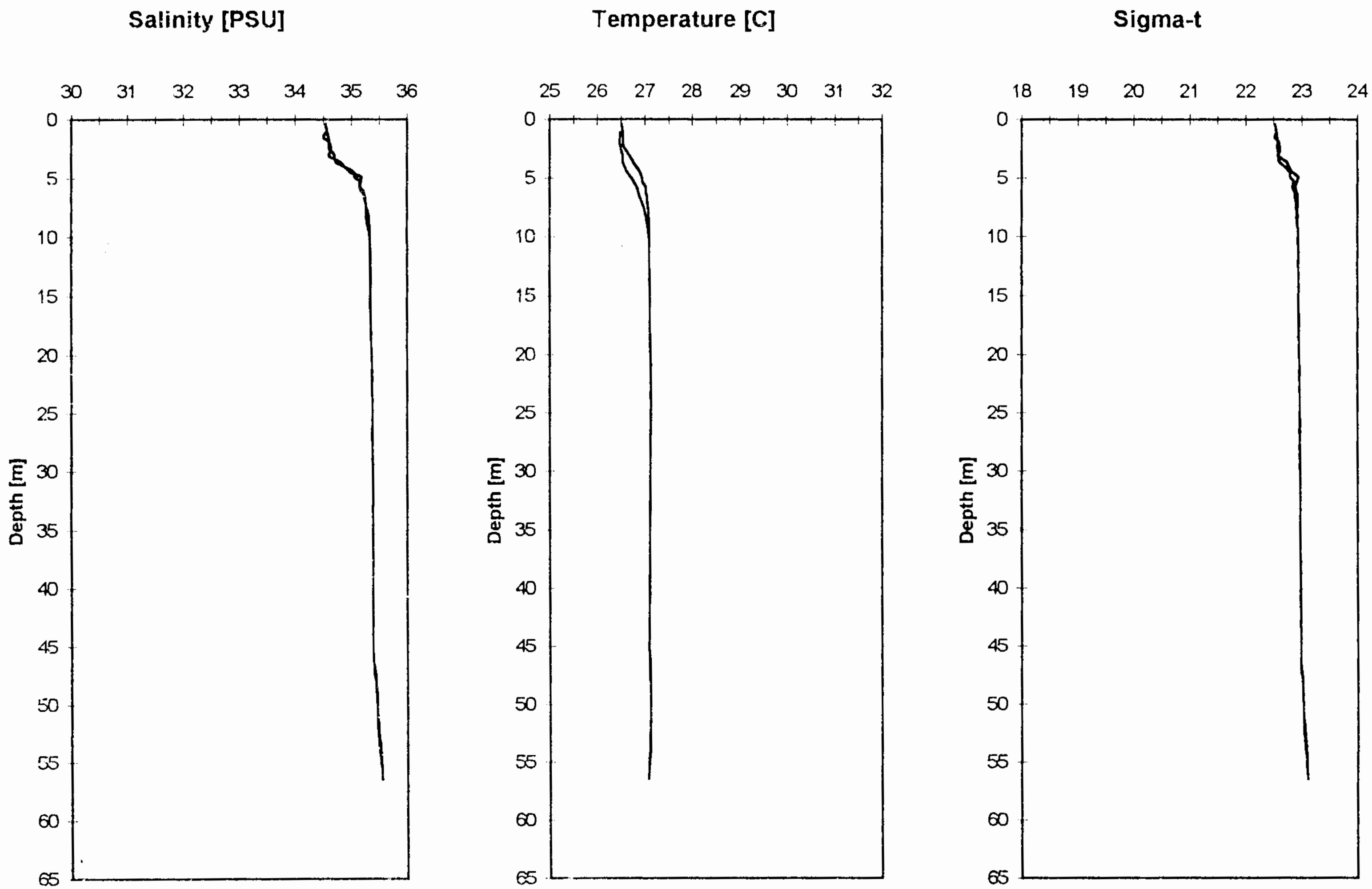
4 September 1997



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Salinity, Temperature, and Density
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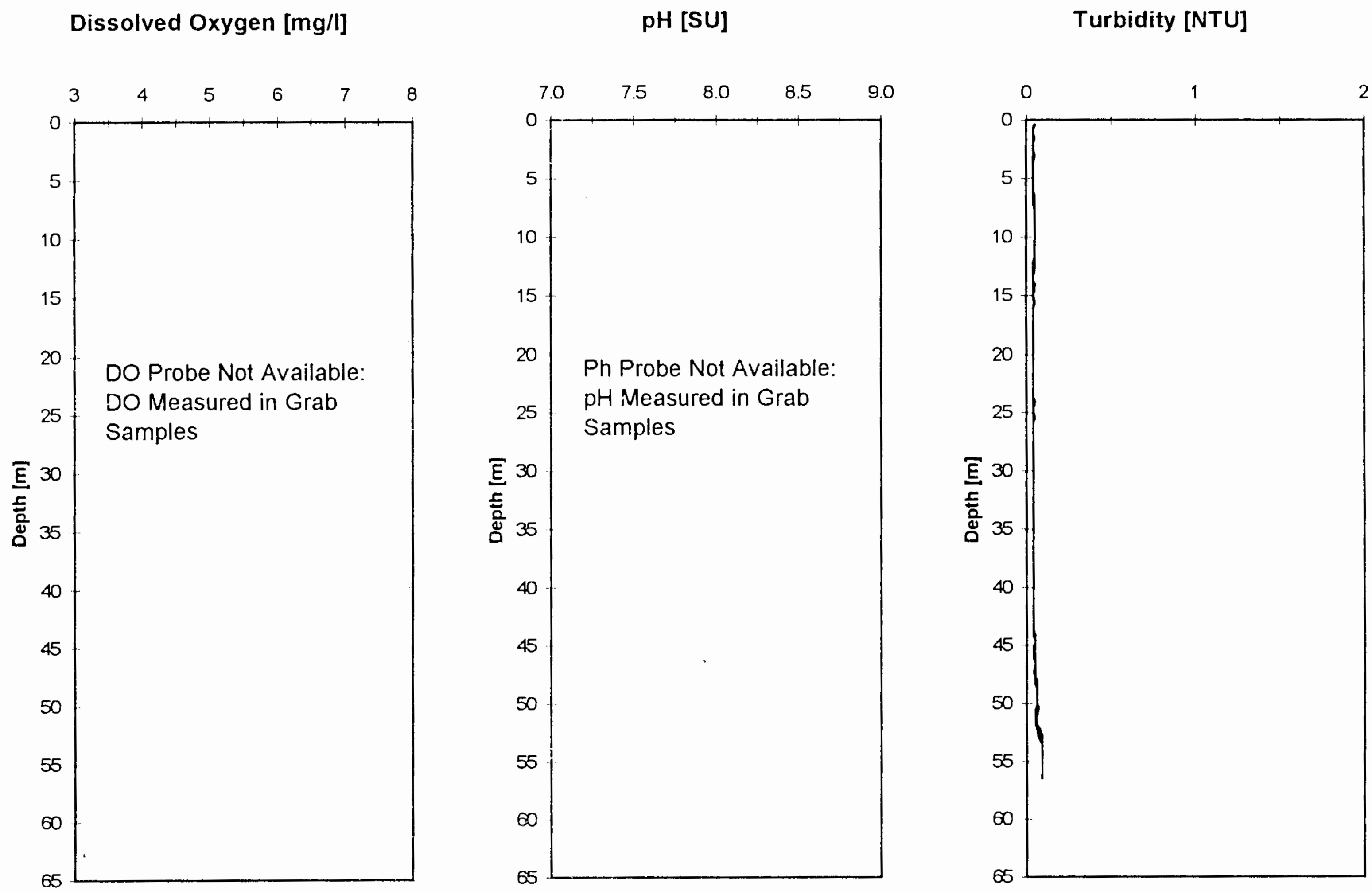

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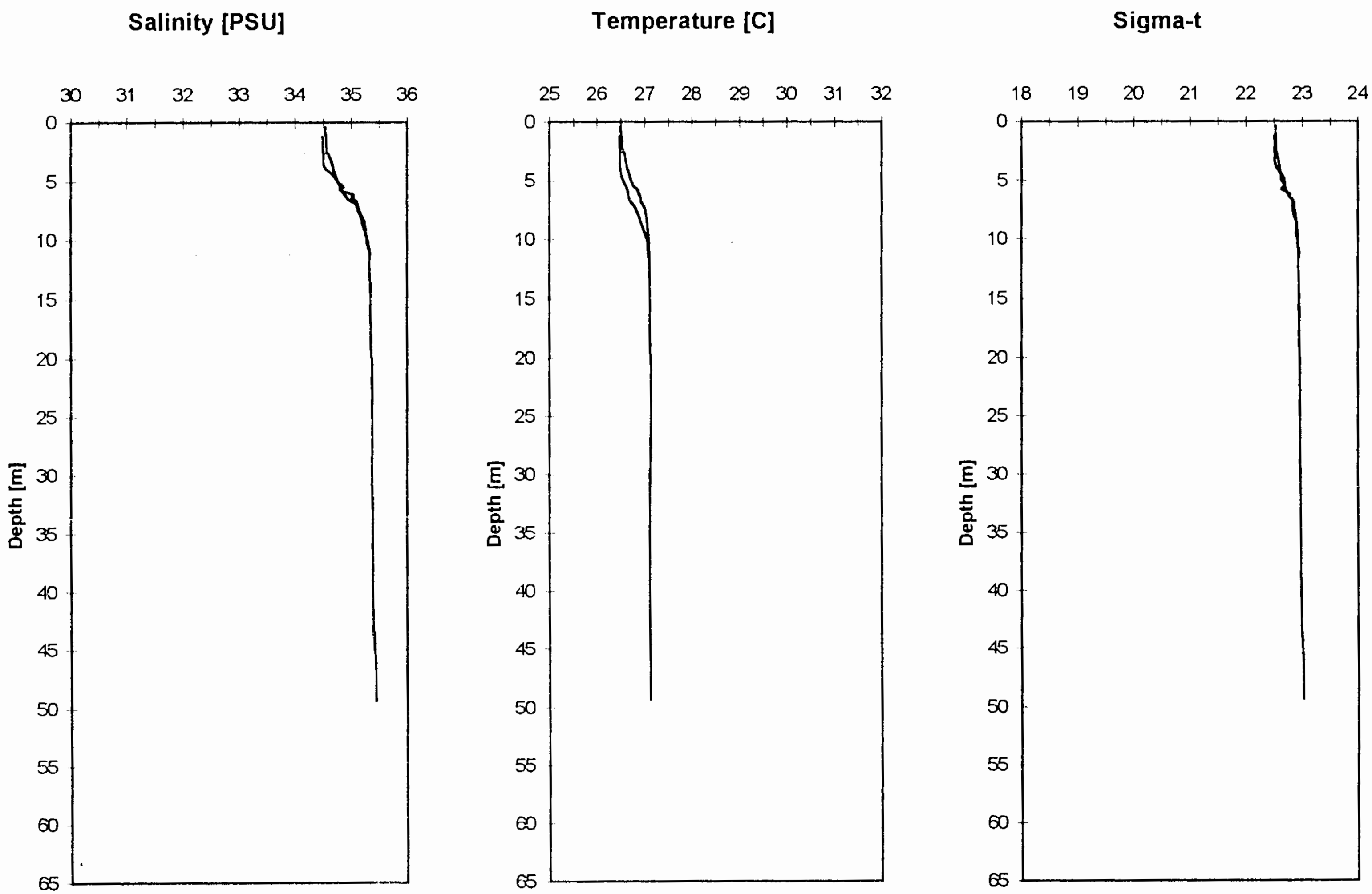
Dissolved Oxygen, pH, and Turbidity
4 September 1997



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Salinity, Temperature, and Density
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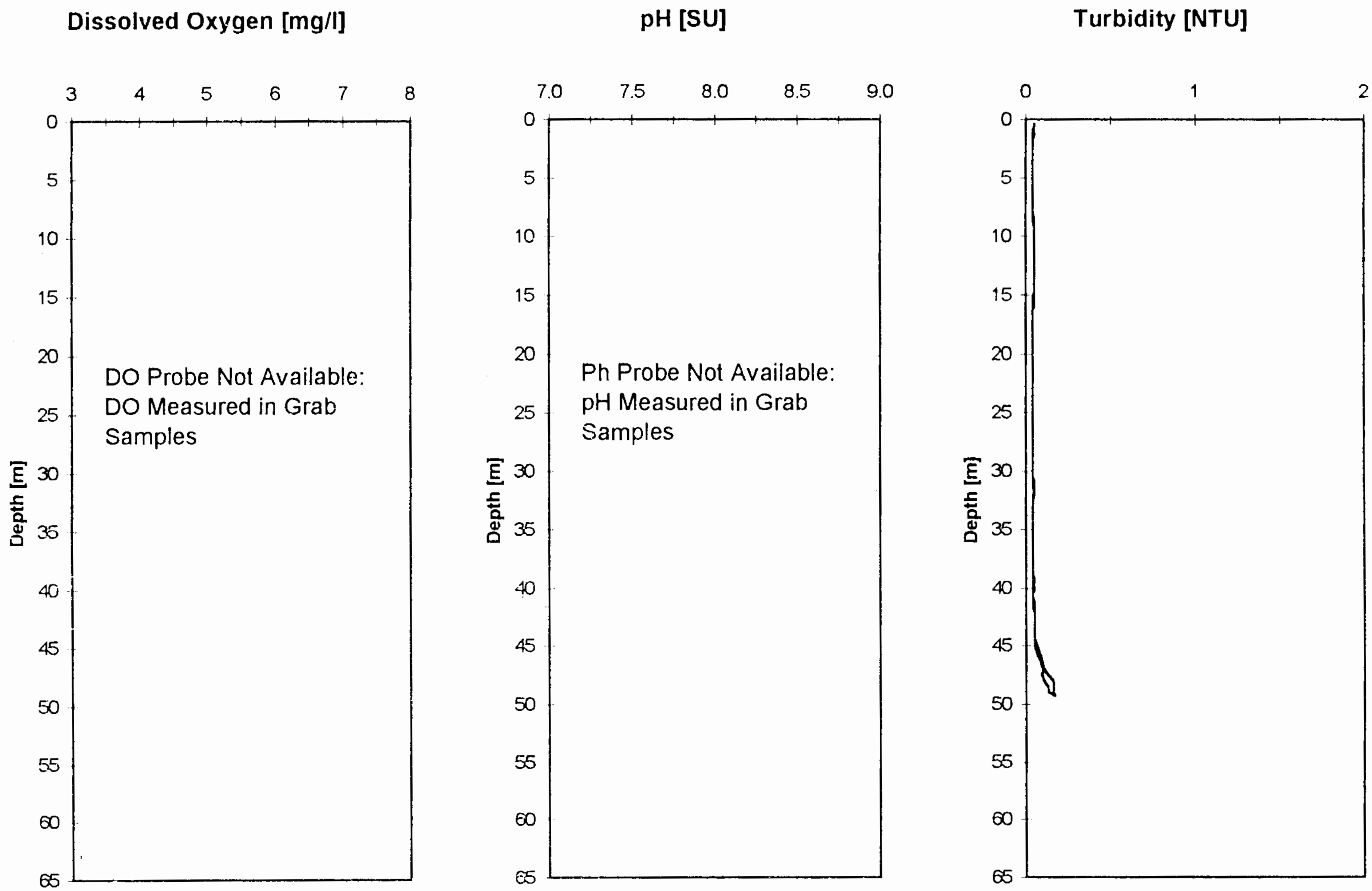

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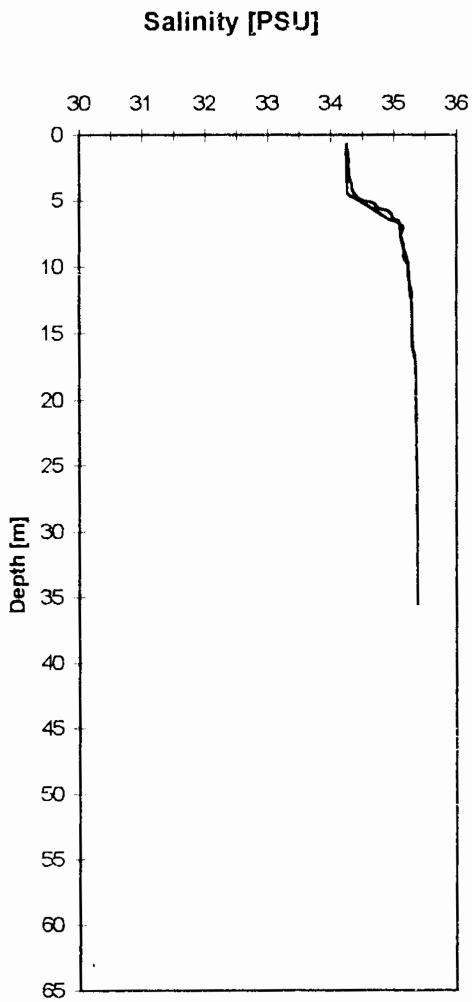
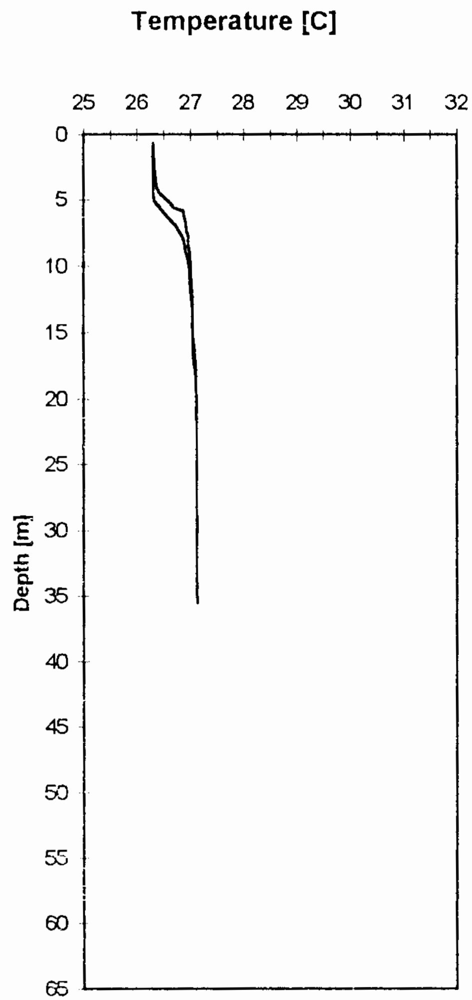
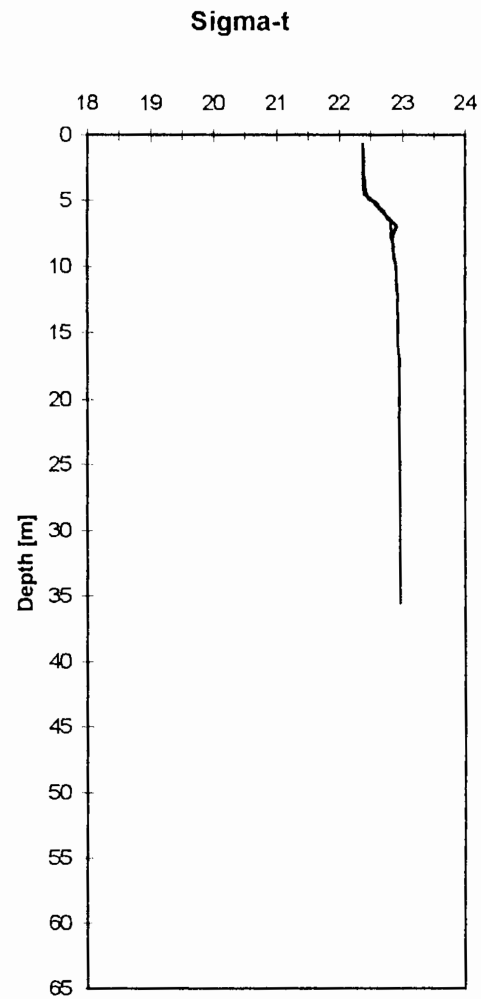
Dissolved Oxygen, pH, and Turbidity
4 September 1997







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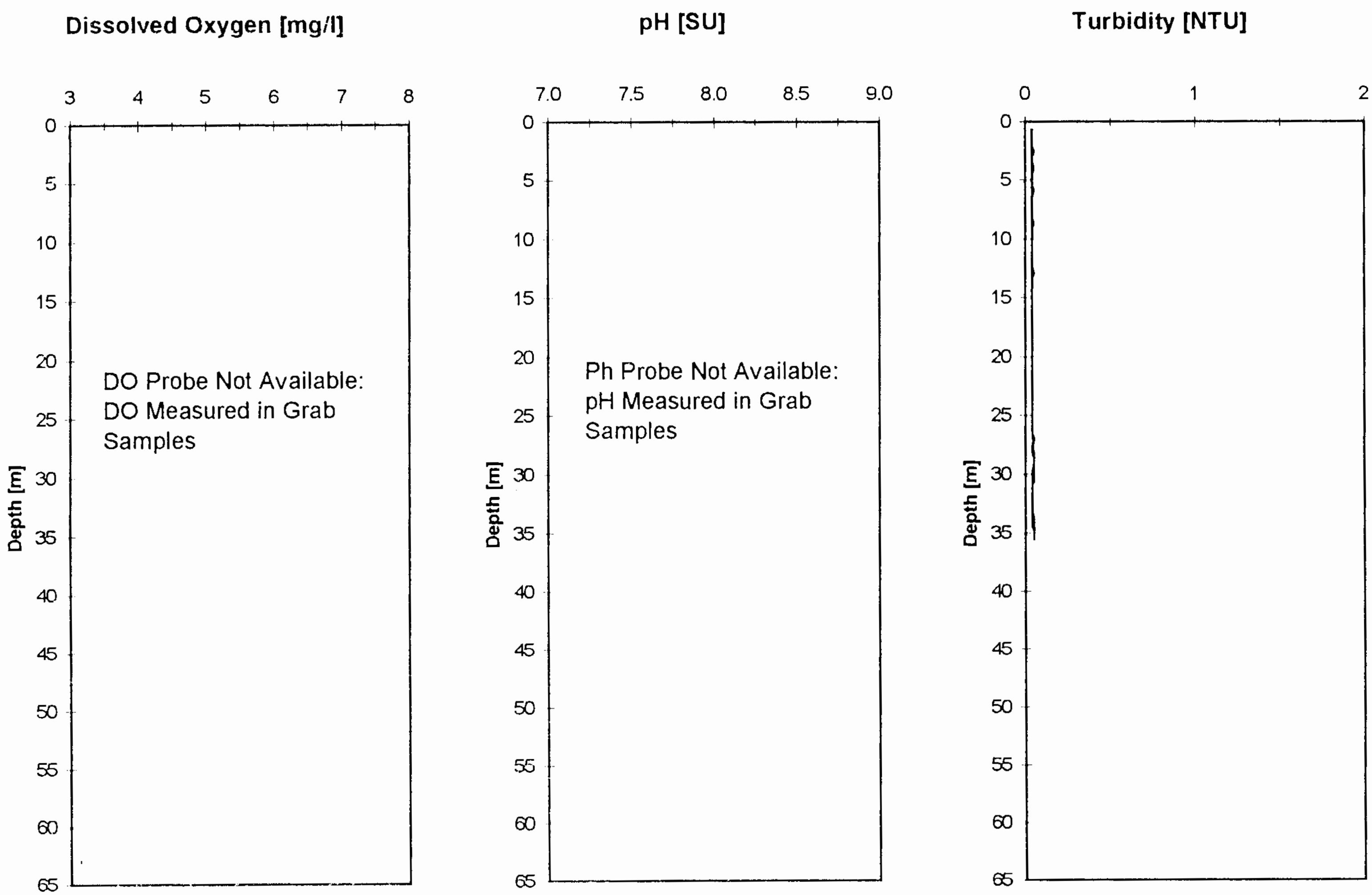
Salinity, Temperature, and Density
4 September 1997



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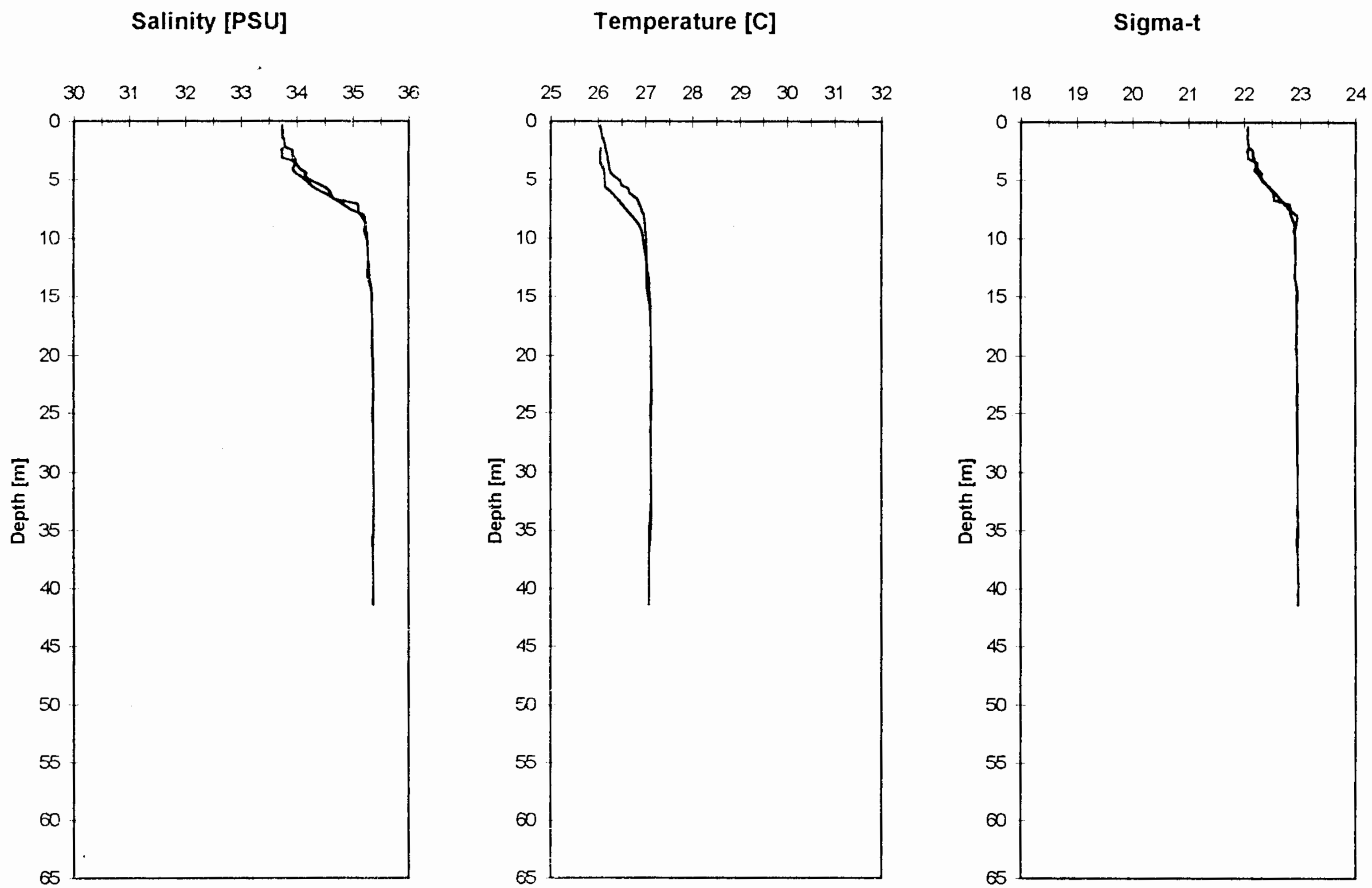
Dissolved Oxygen, pH, and Turbidity
4 September 1997

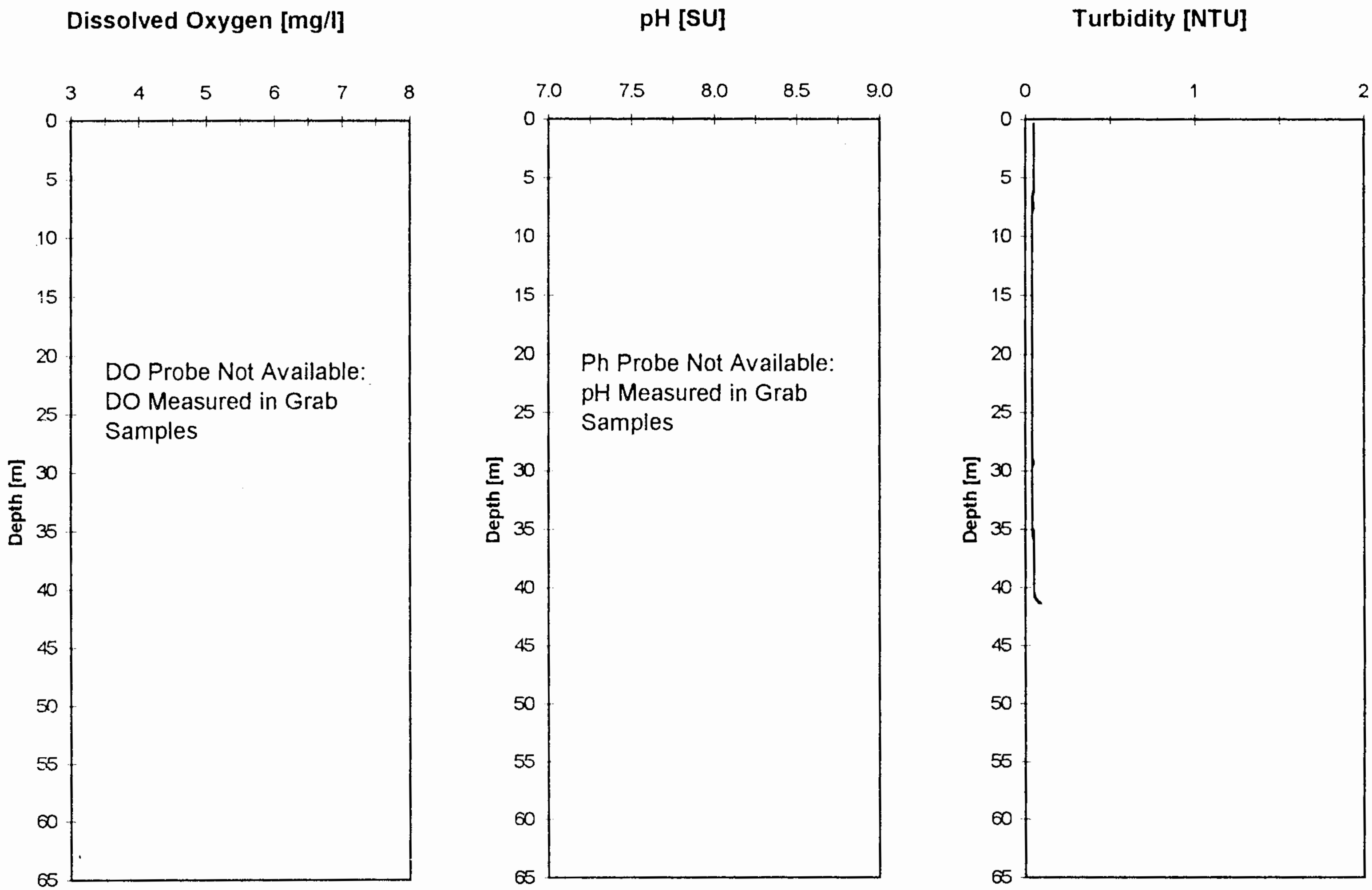


Station 9A

Pago Pago Harbor Water Quality Monitoring Profiles

Salinity, Temperature, and Density

4 September 1997

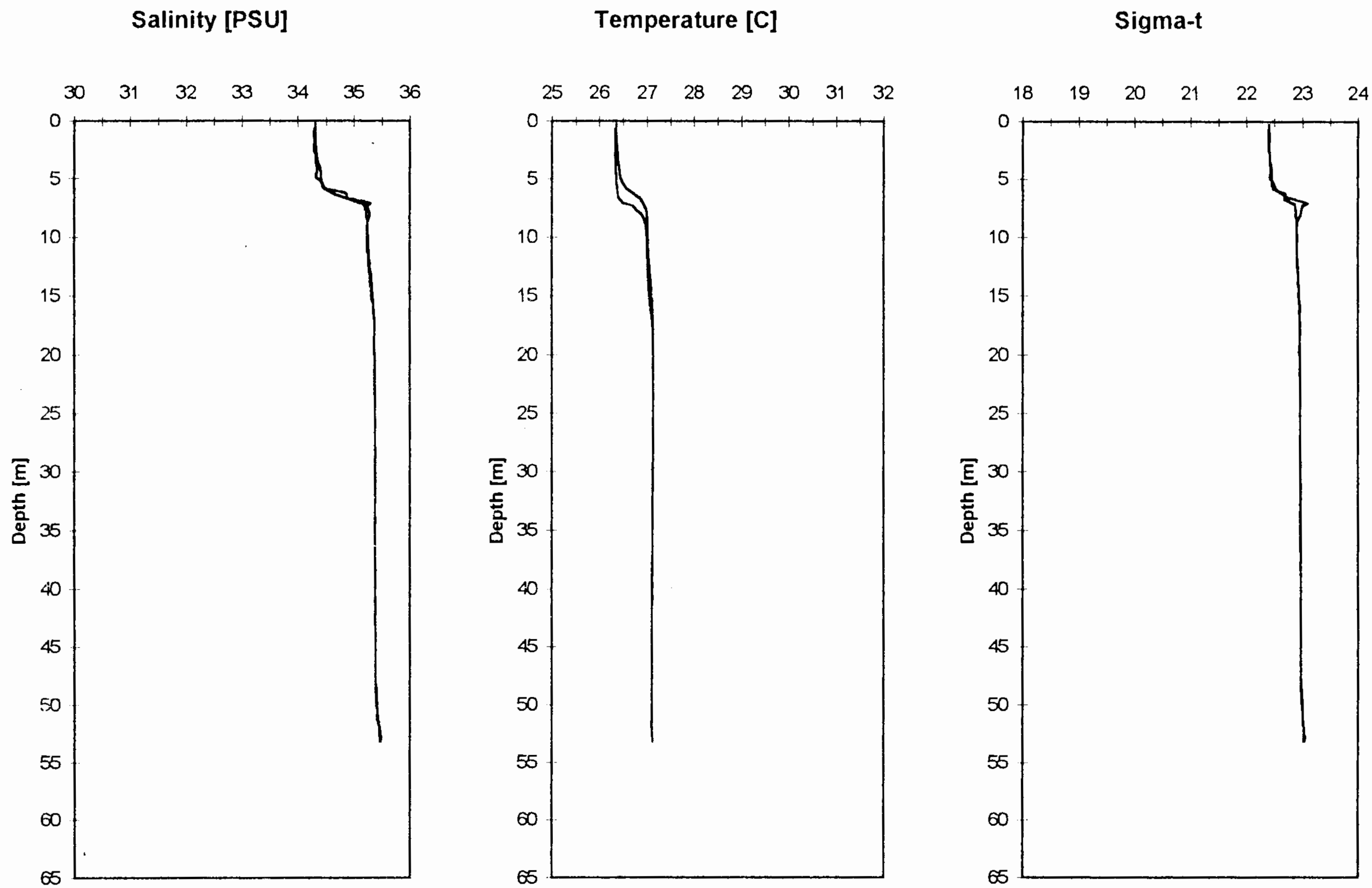


Station 9A

Pago Pago Harbor Water Quality Monitoring Profiles

Dissolved Oxygen, pH, and Turbidity

4 September 1997



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Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
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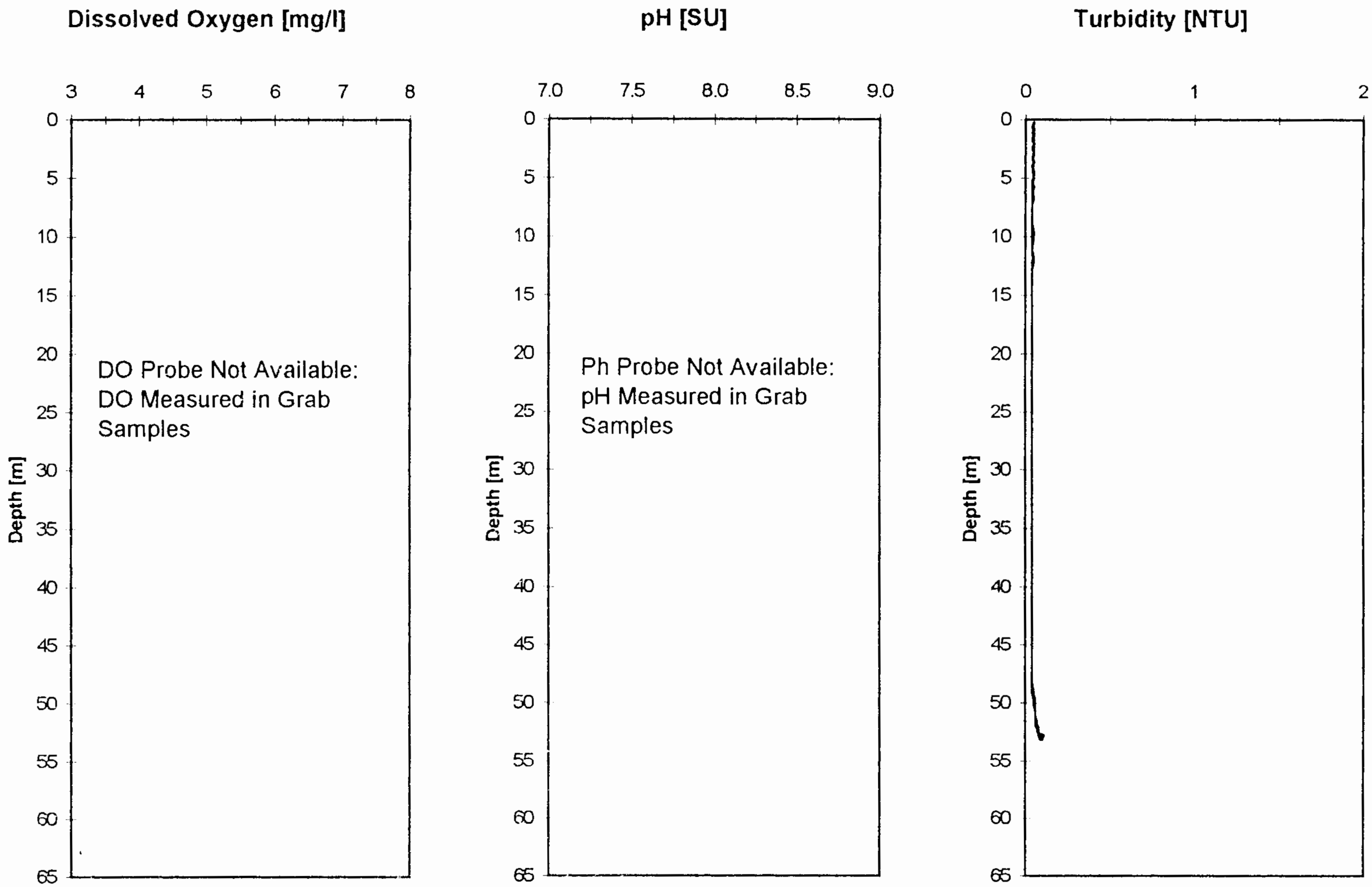

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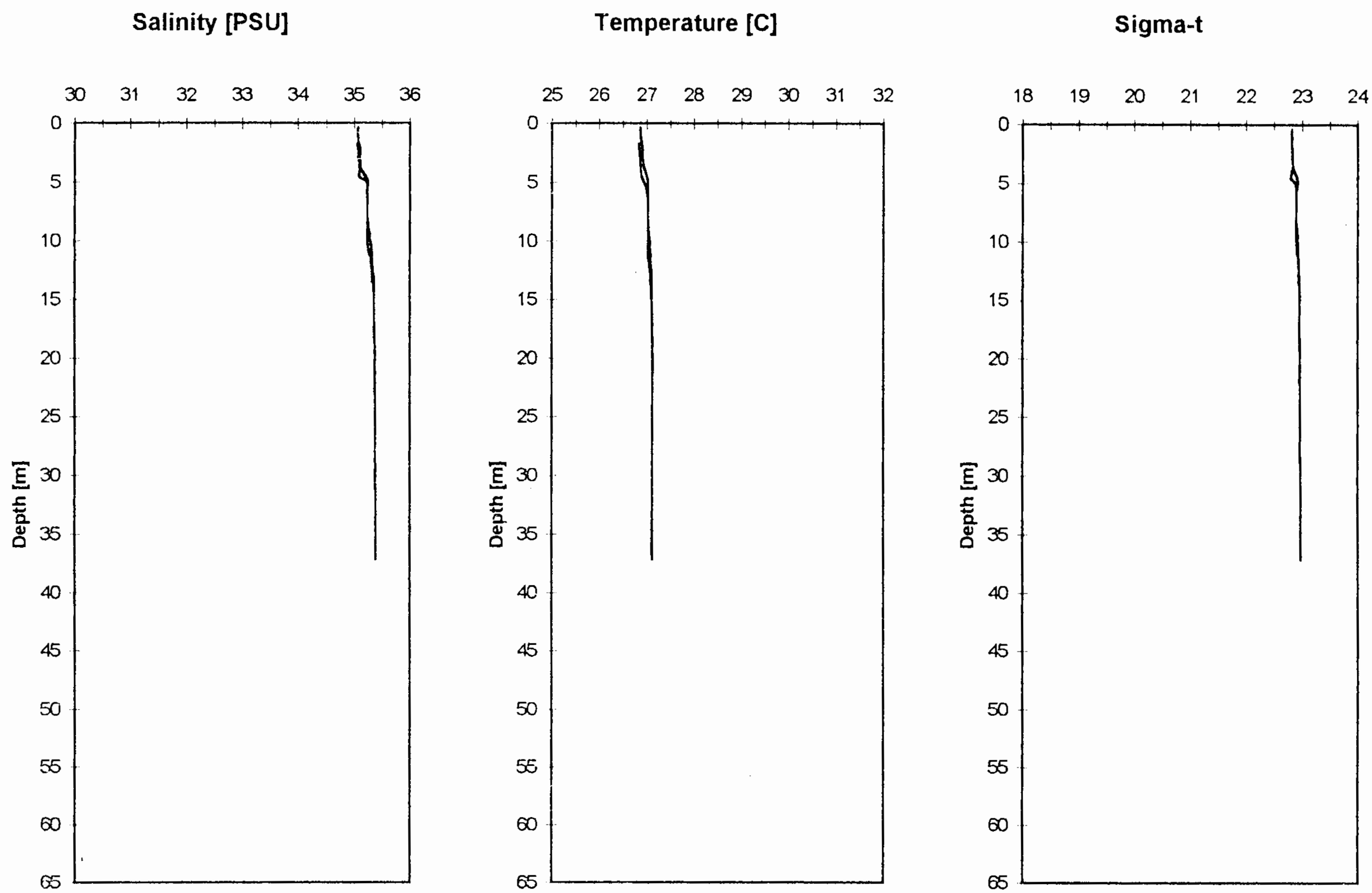

Station 10A
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Salinity, Temperature, and Density
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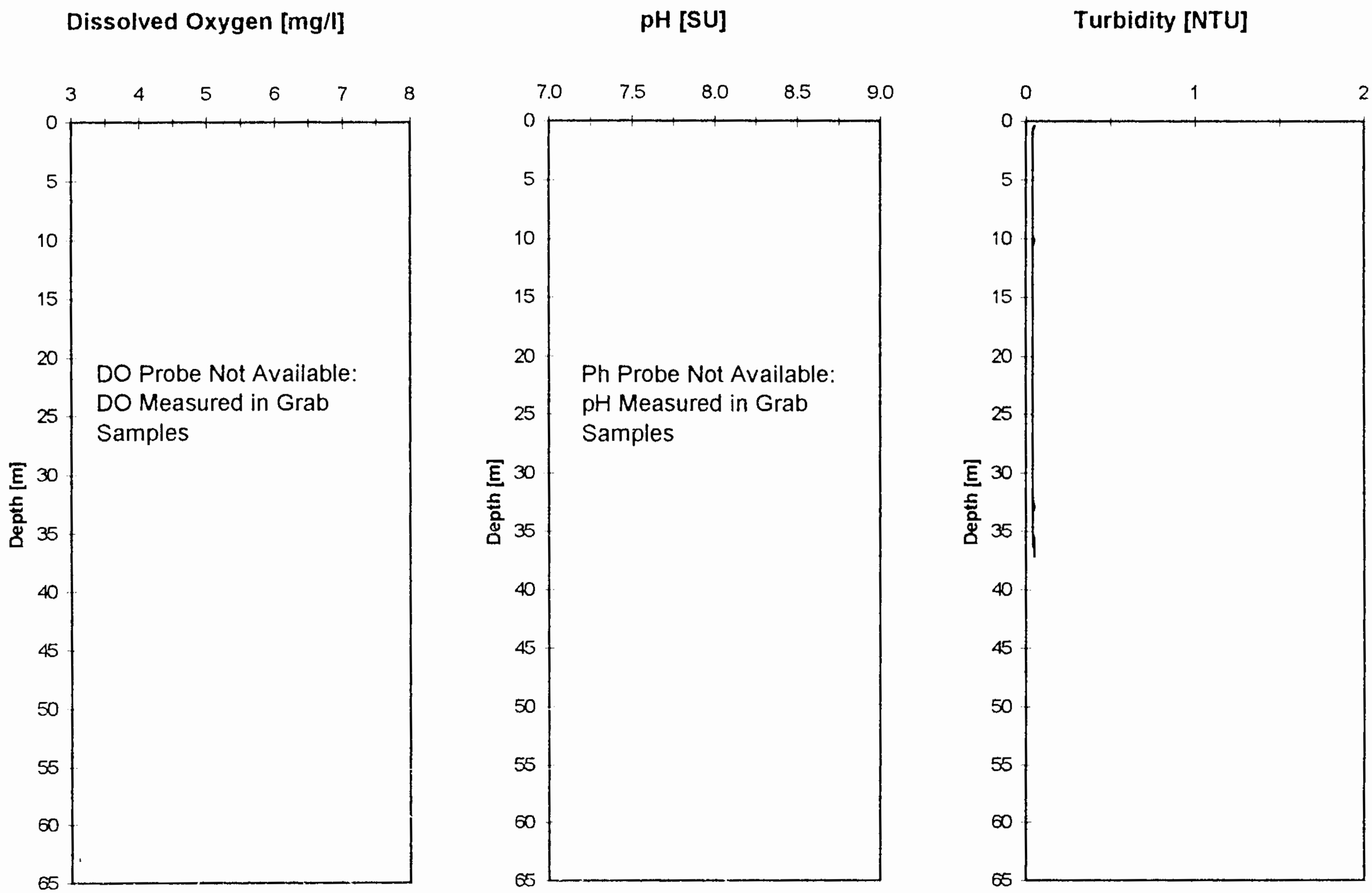

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Dissolved Oxygen, pH, and Turbidity
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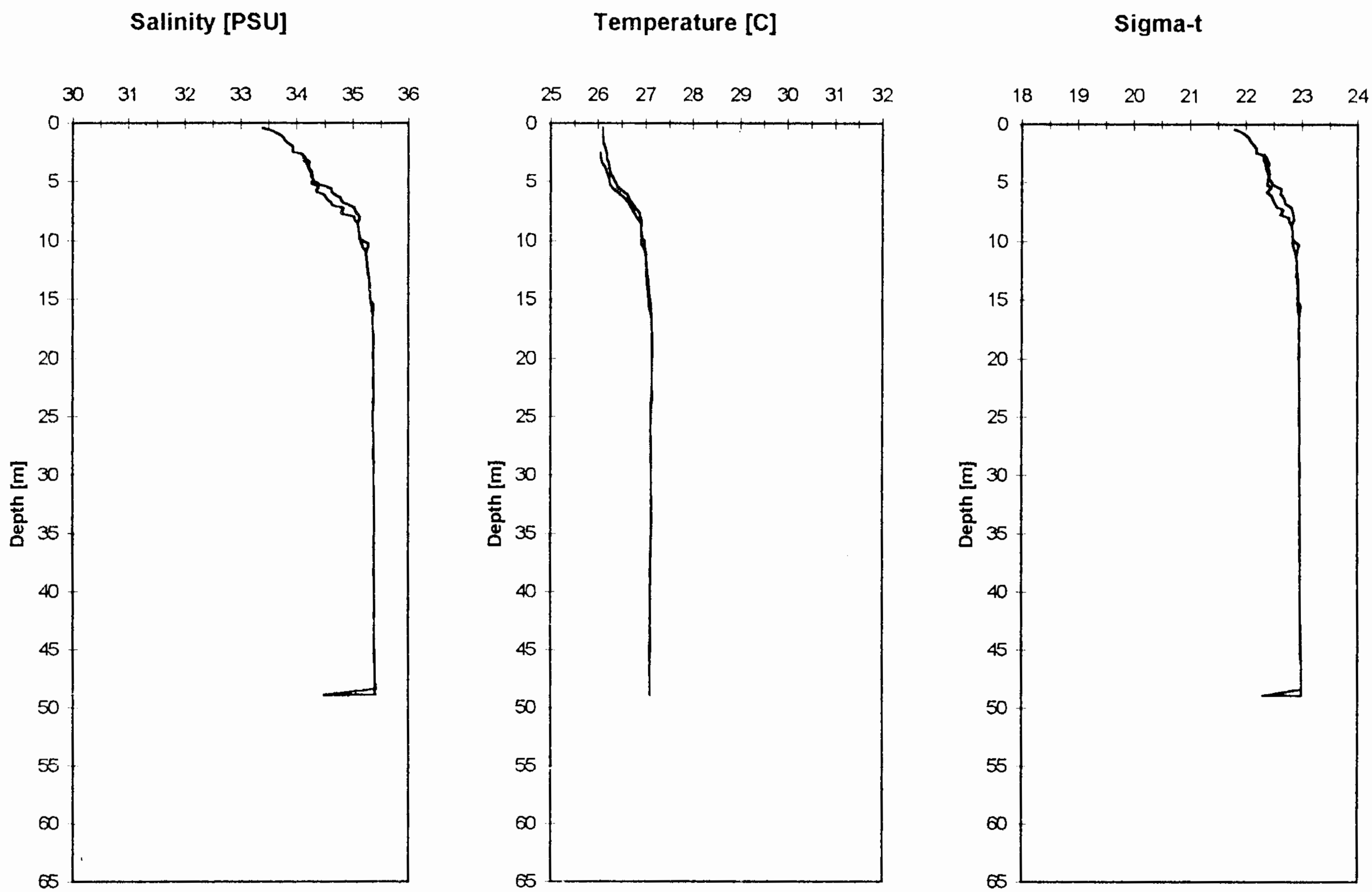

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Salinity, Temperature, and Density
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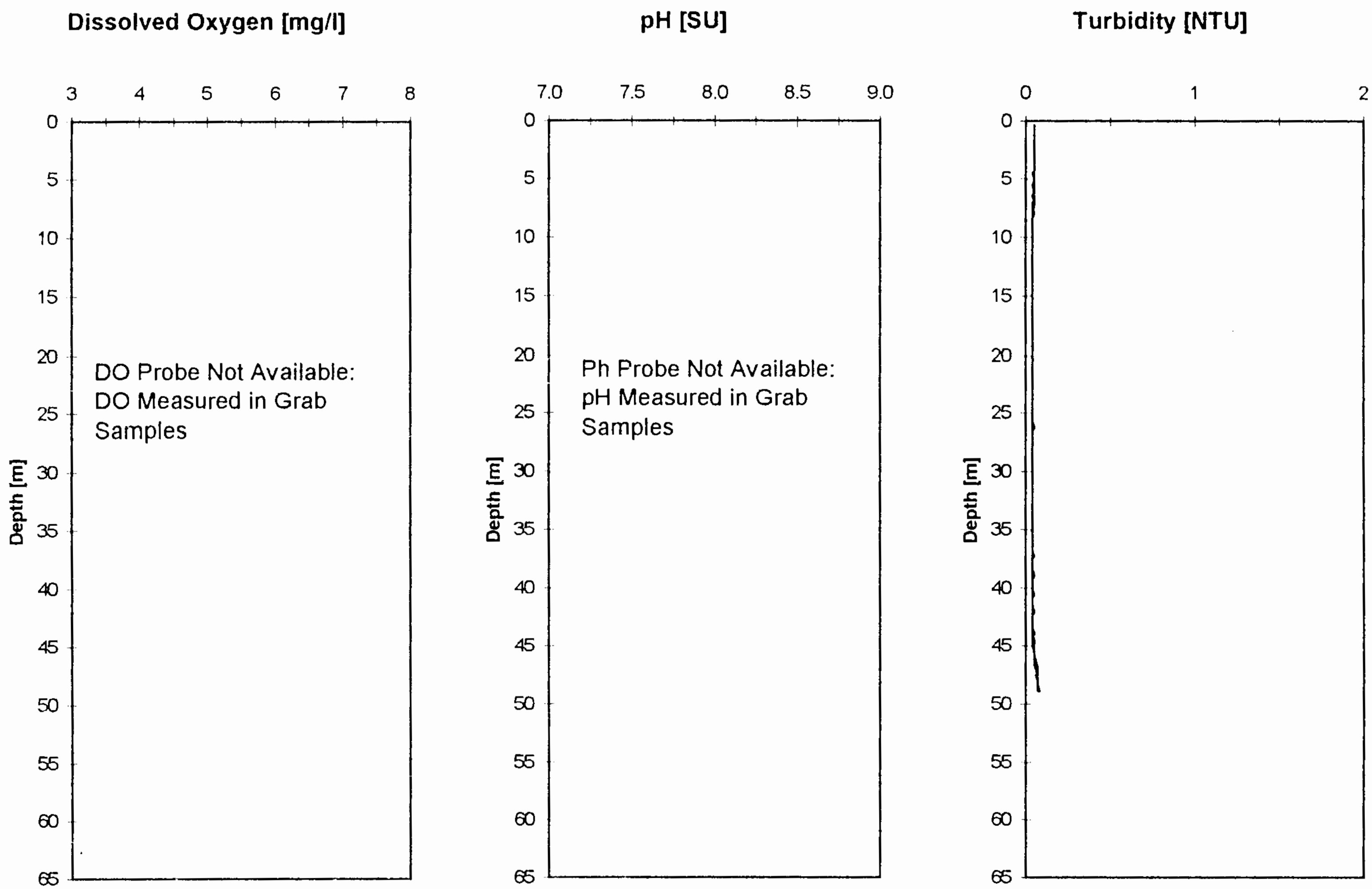

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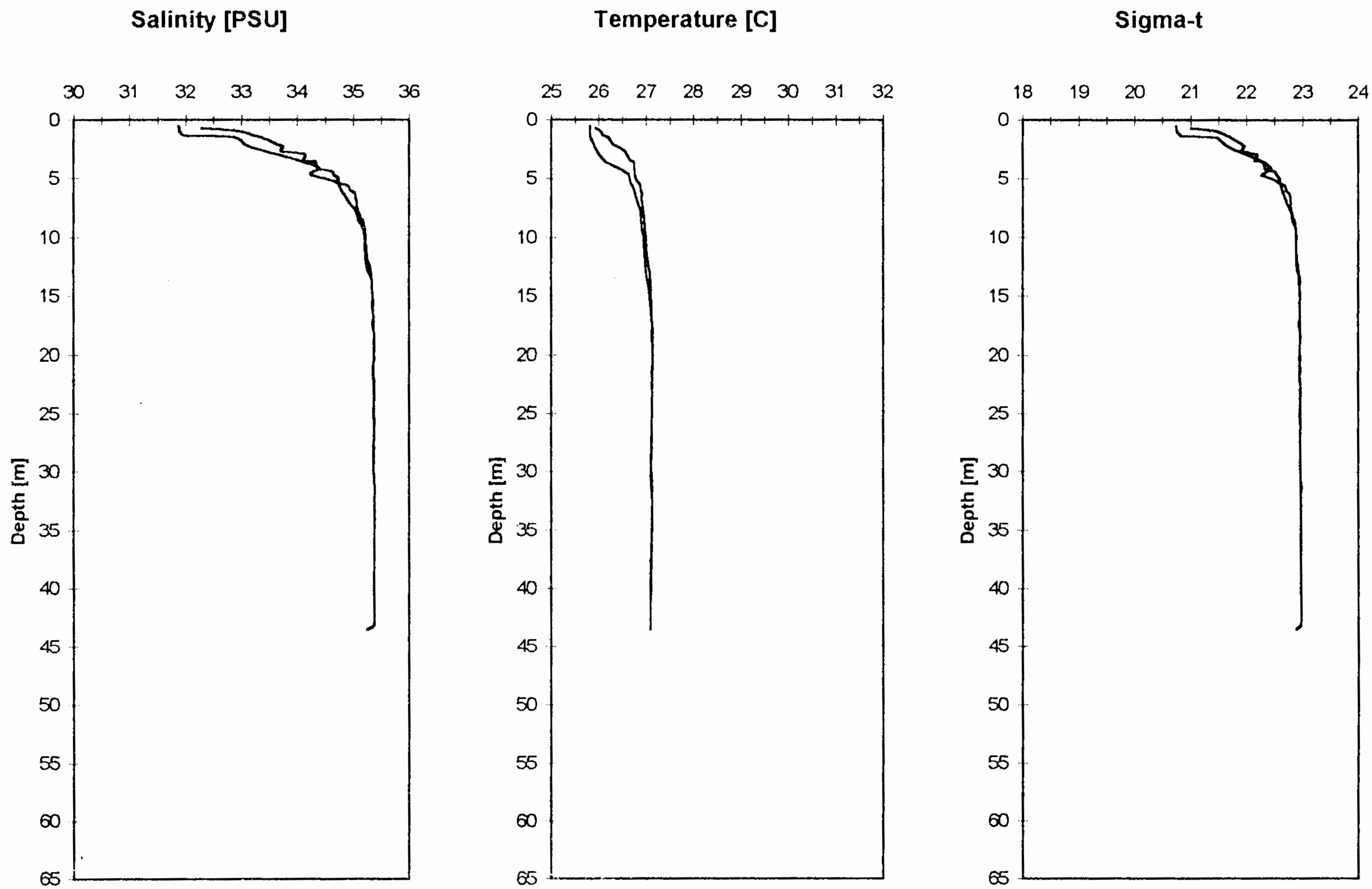
Dissolved Oxygen, pH, and Turbidity
4 September 1997



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Salinity, Temperature, and Density
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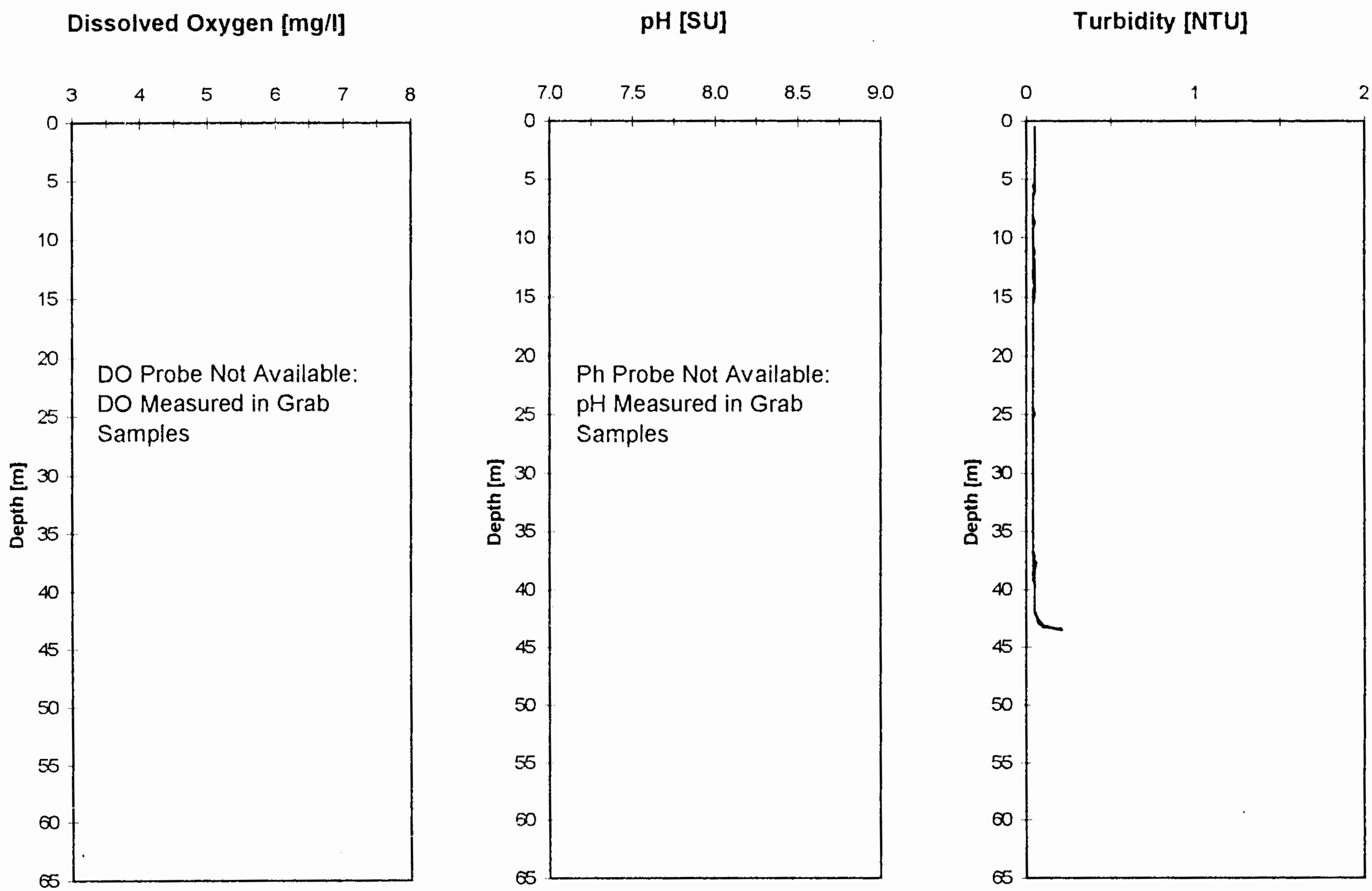

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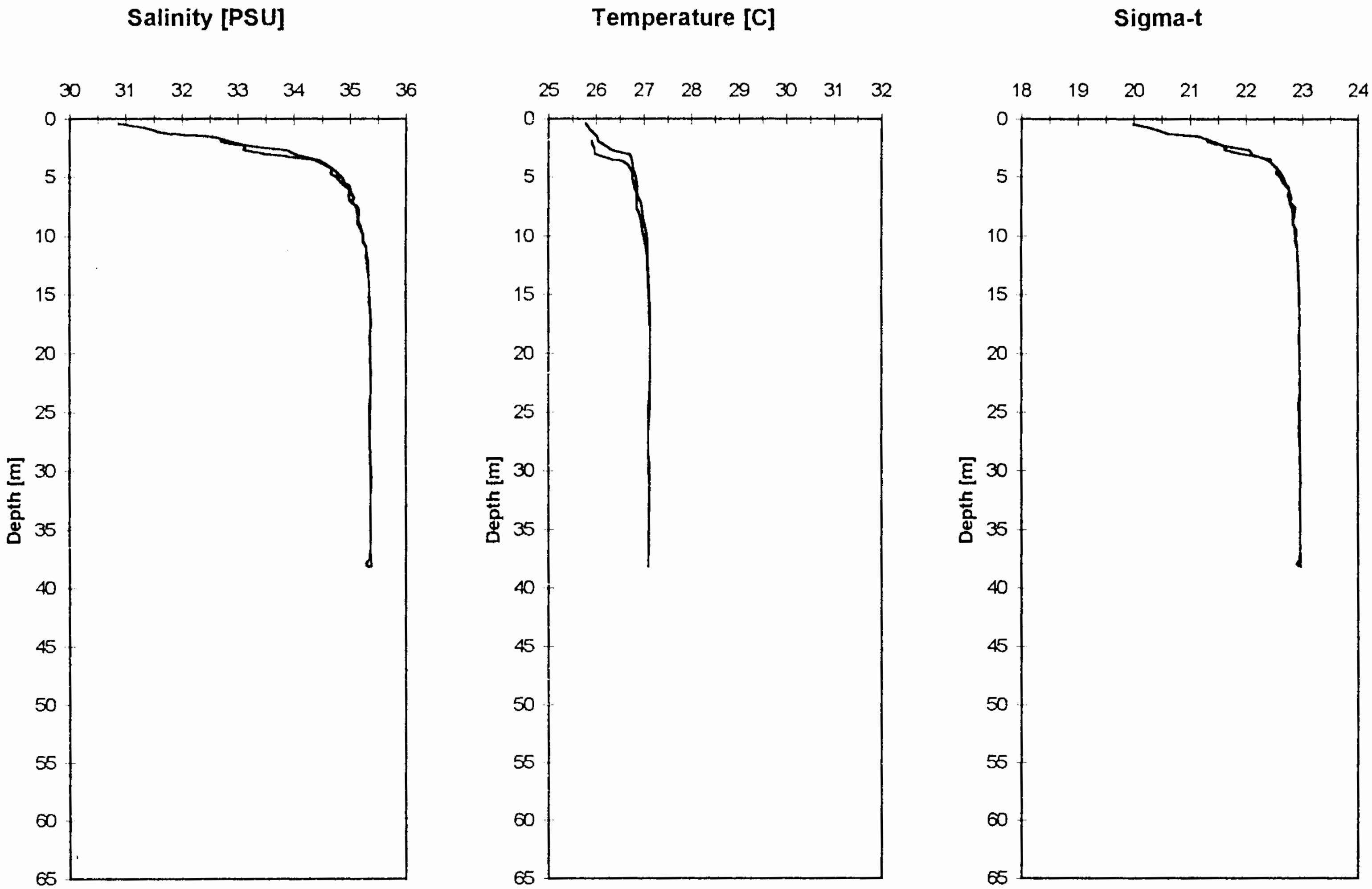
Dissolved Oxygen, pH, and Turbidity
4 September 1997



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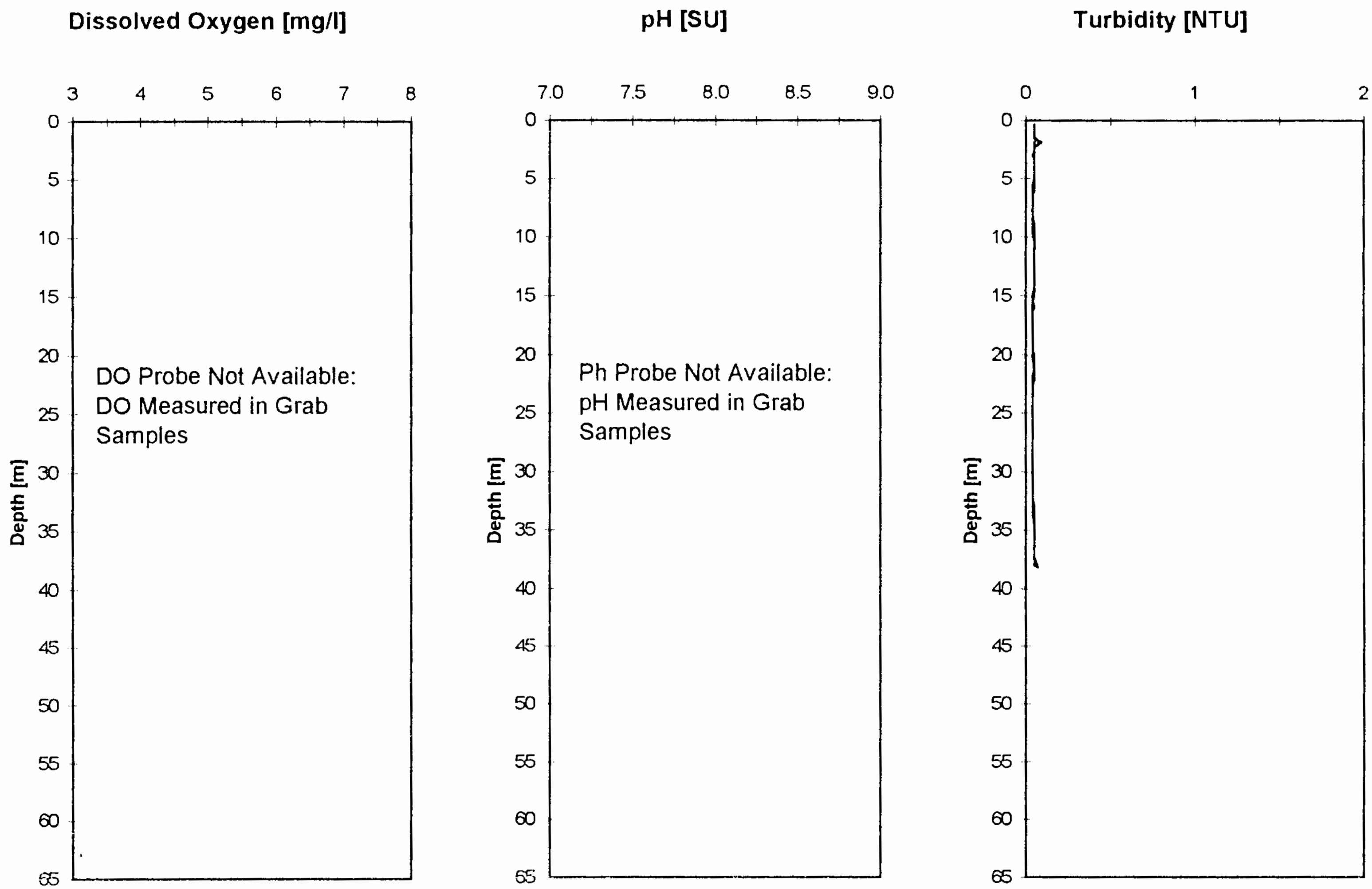

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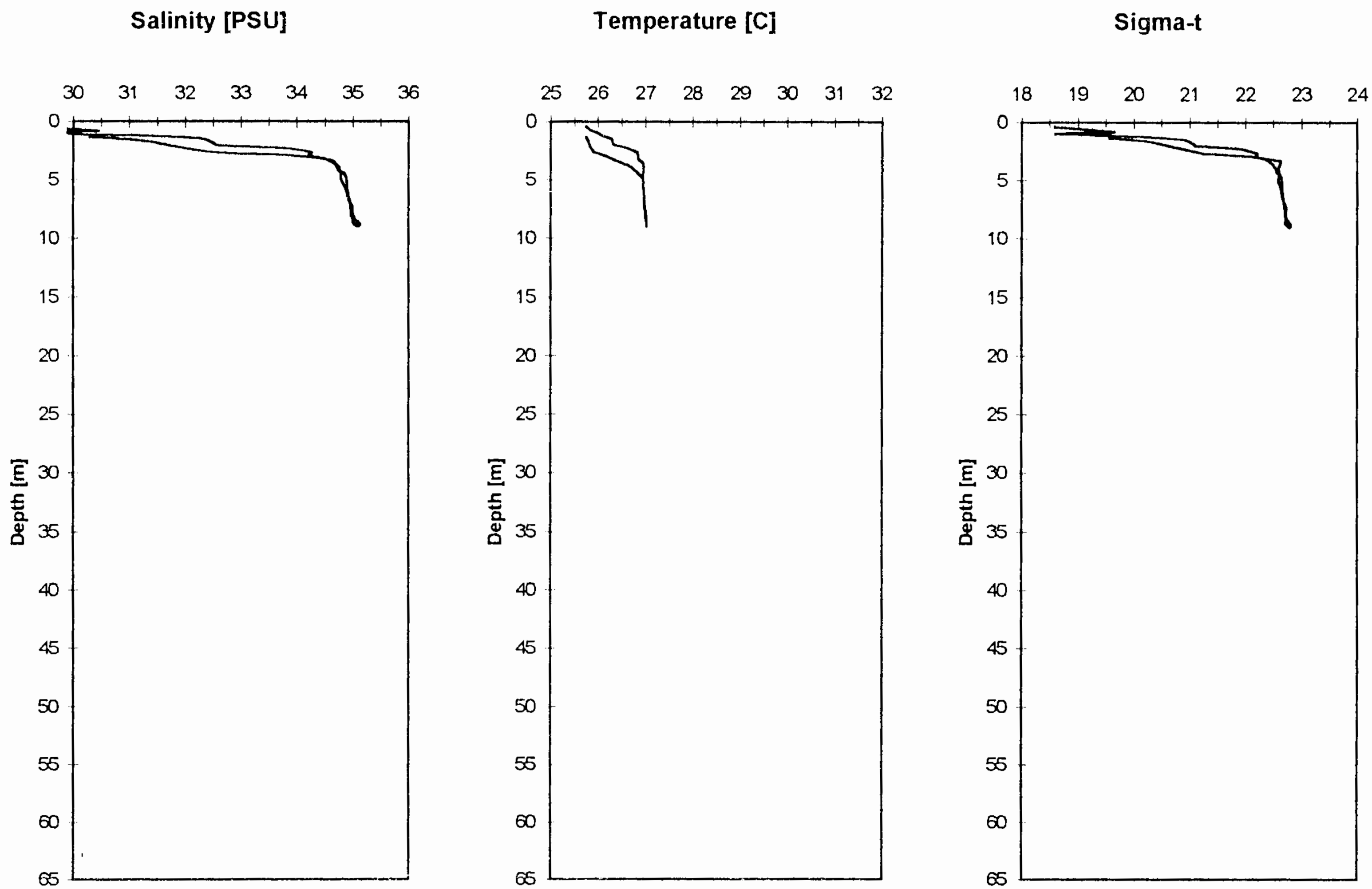
4 September 1997



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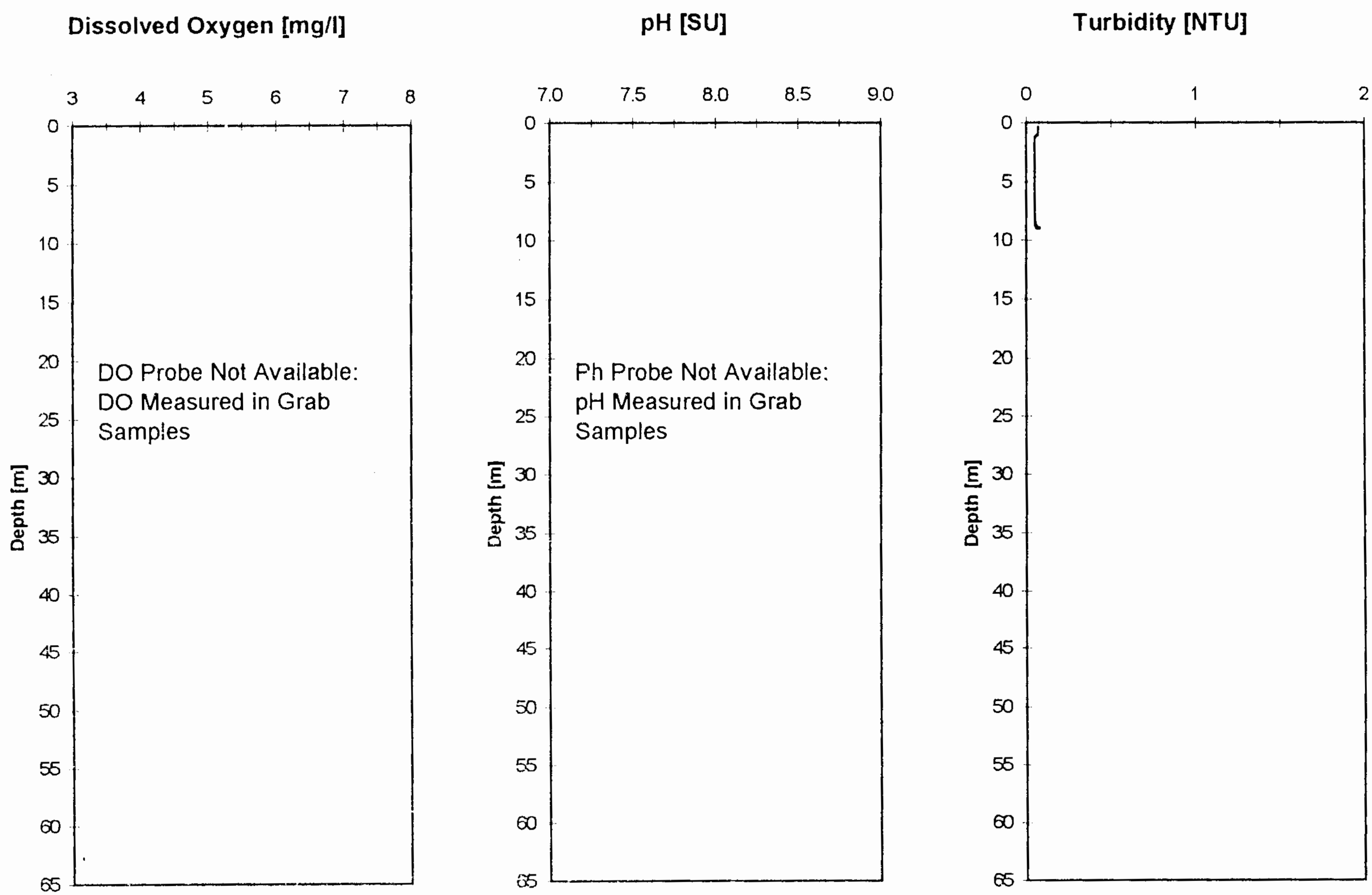
Salinity, Temperature, and Density
4 September 1997



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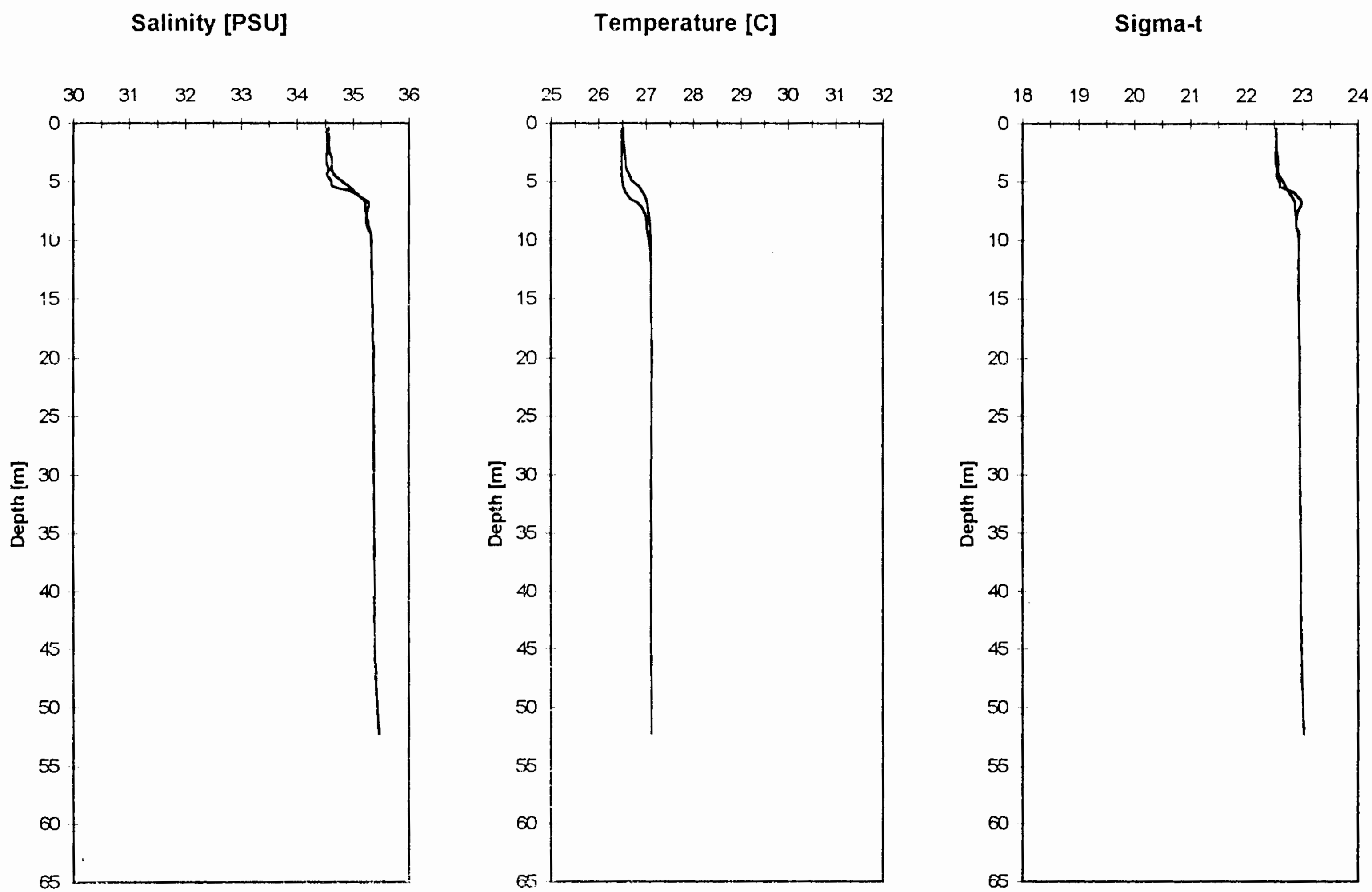
Dissolved Oxygen, pH, and Turbidity
4 September 1997



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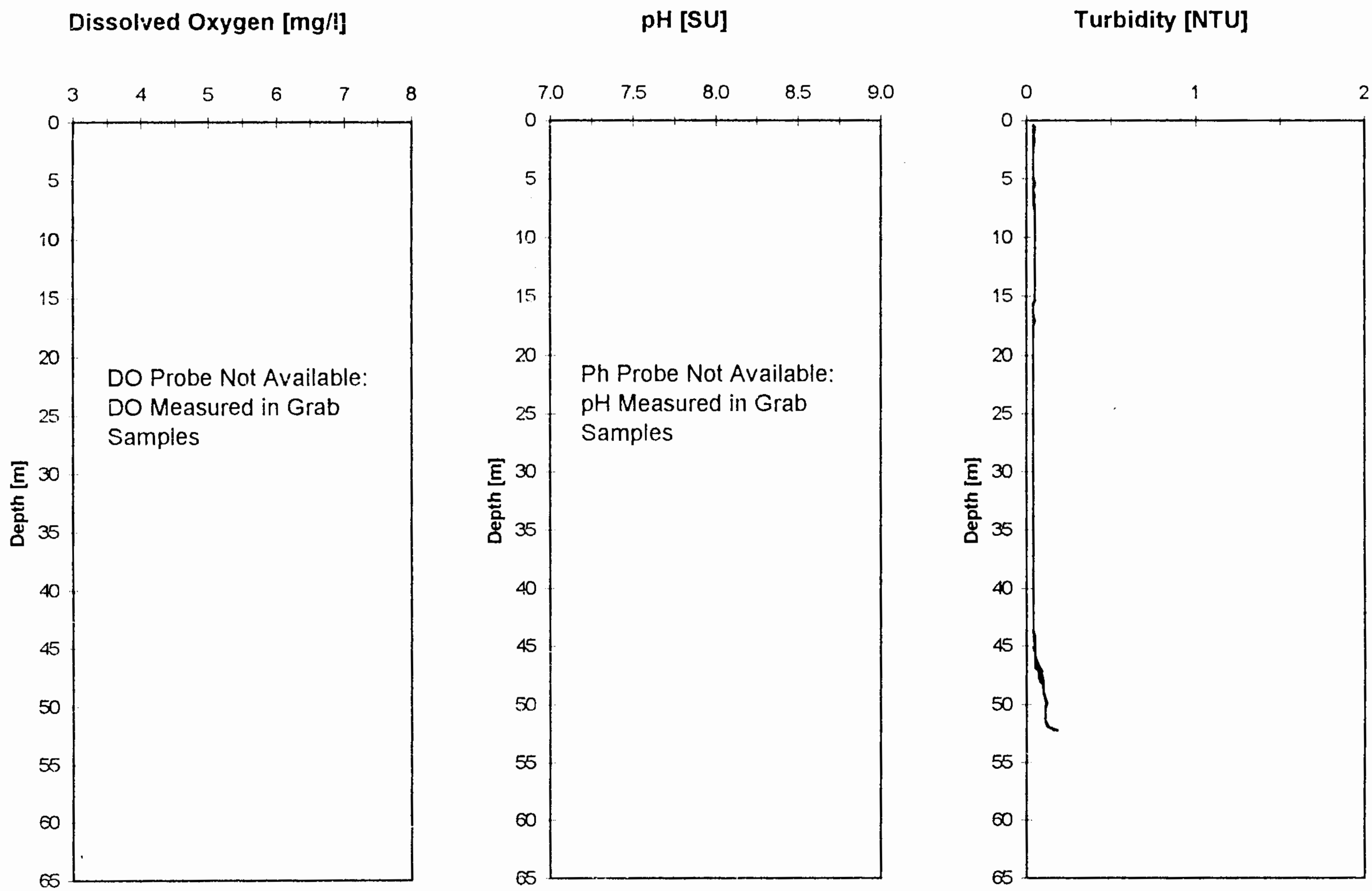

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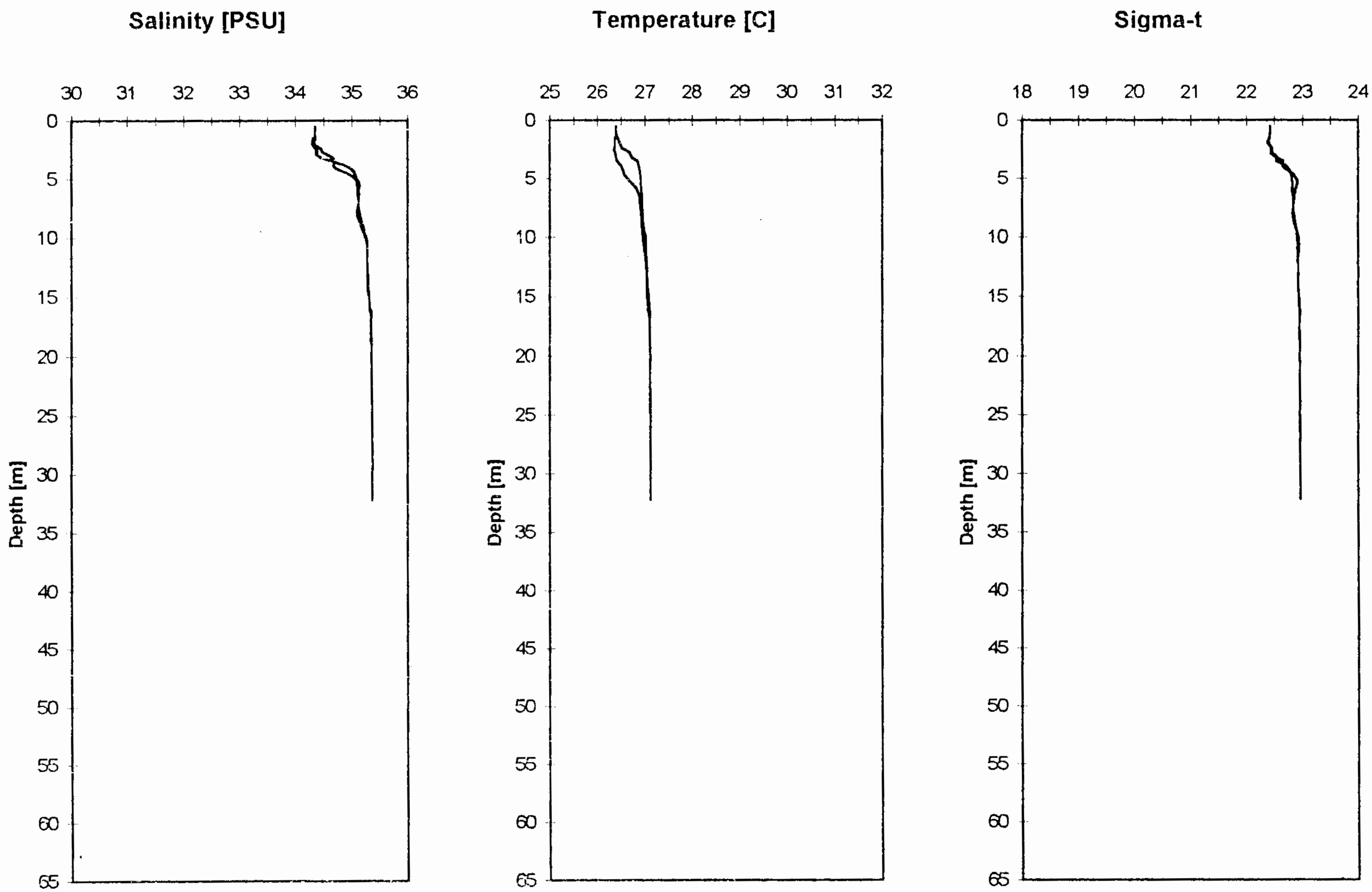
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
4 September 1997

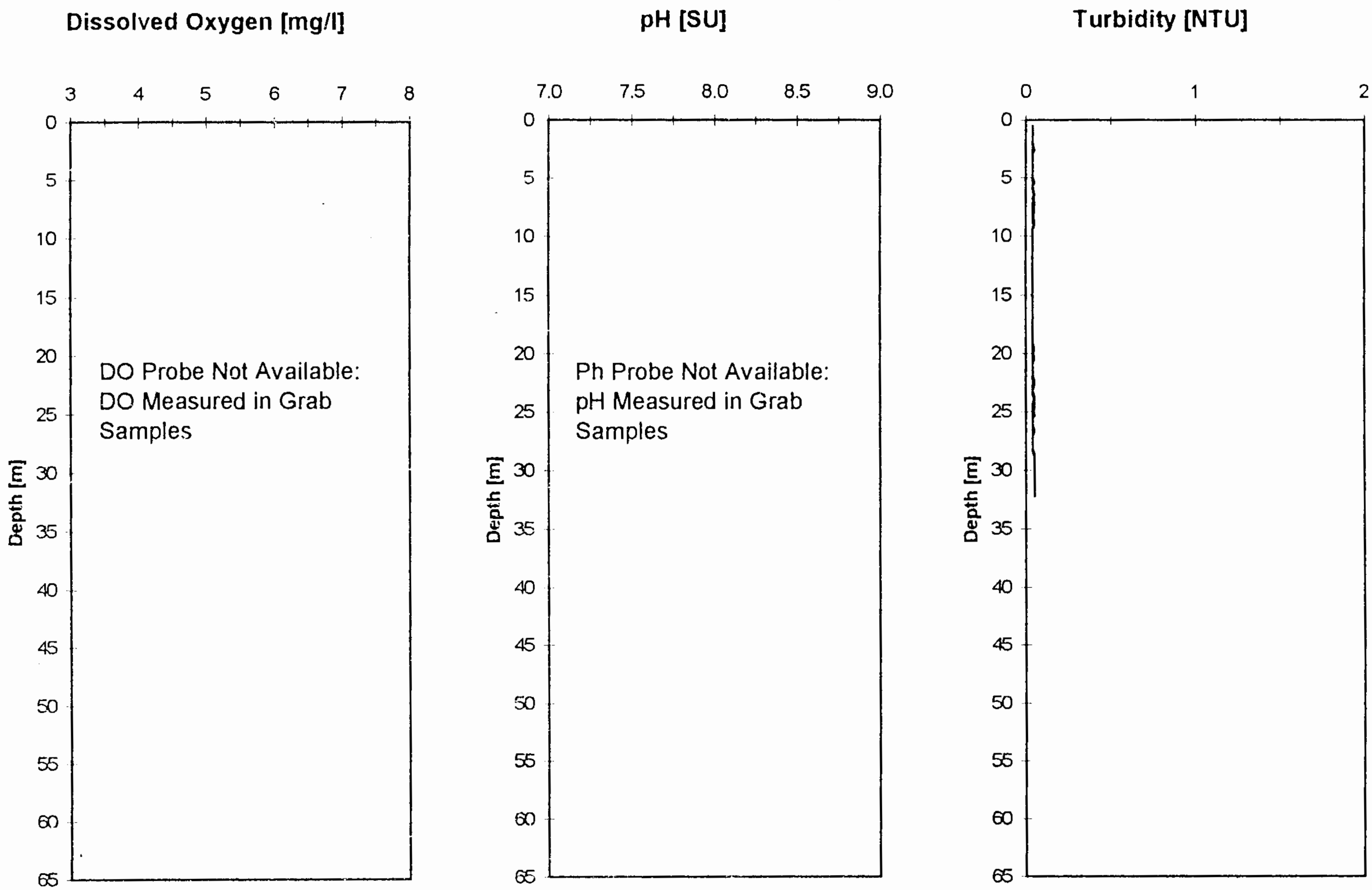


Station 15

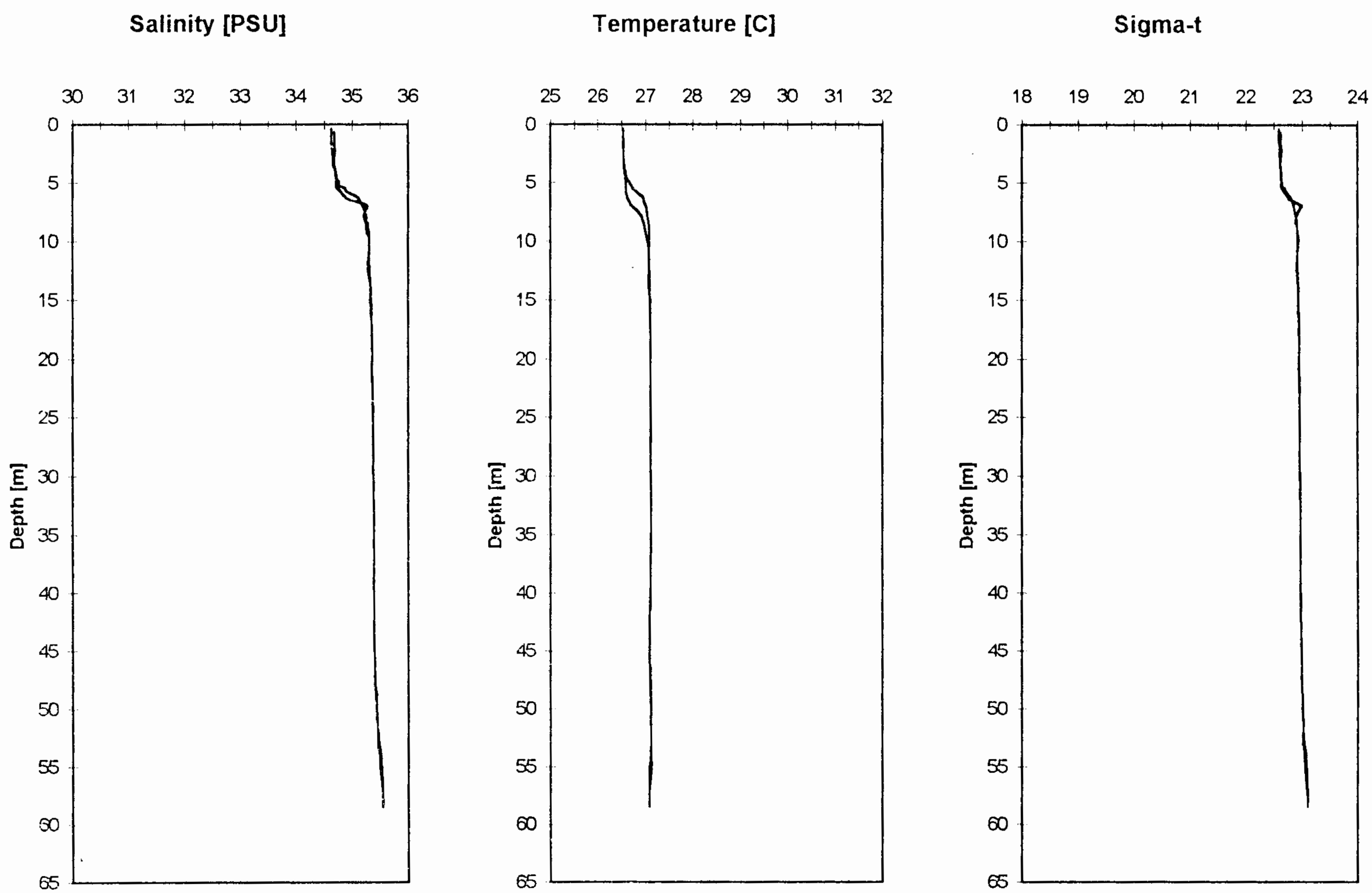
Pago Pago Harbor Water Quality Monitoring Profiles

Salinity, Temperature, and Density

4 September 1997



Station 15
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
4 September 1997

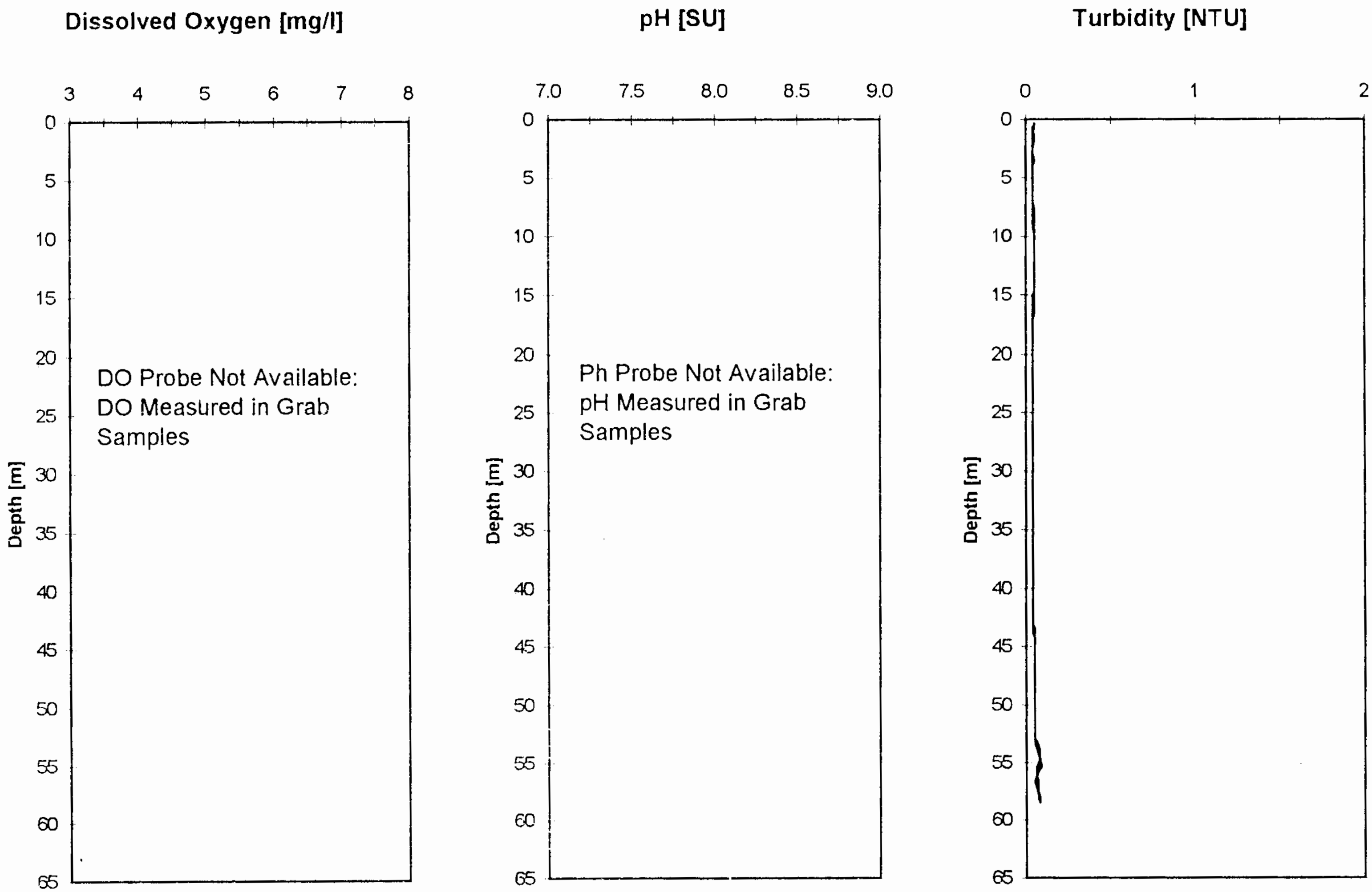


Station 16

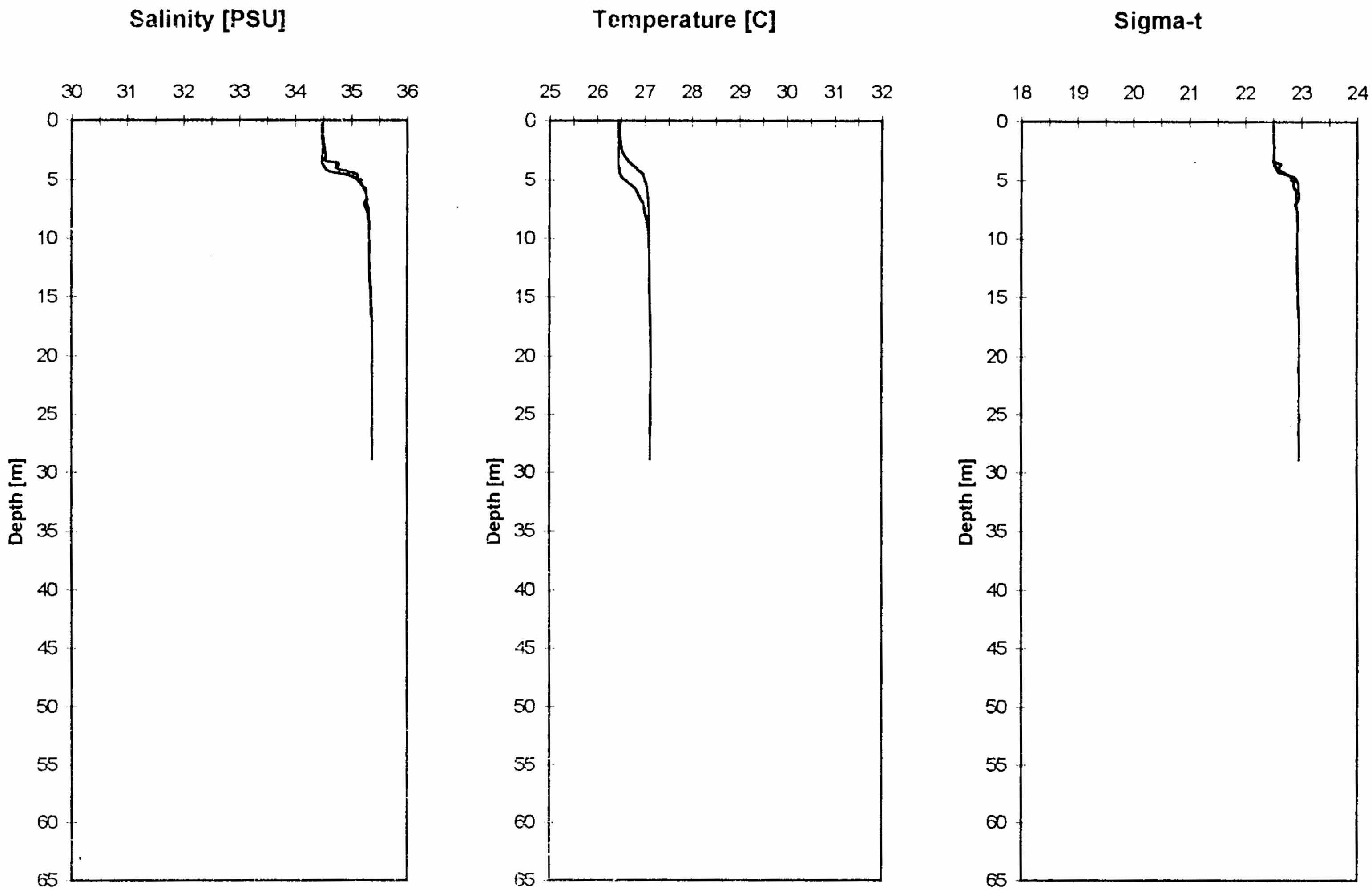
Pago Pago Harbor Water Quality Monitoring Profiles

Salinity, Temperature, and Density

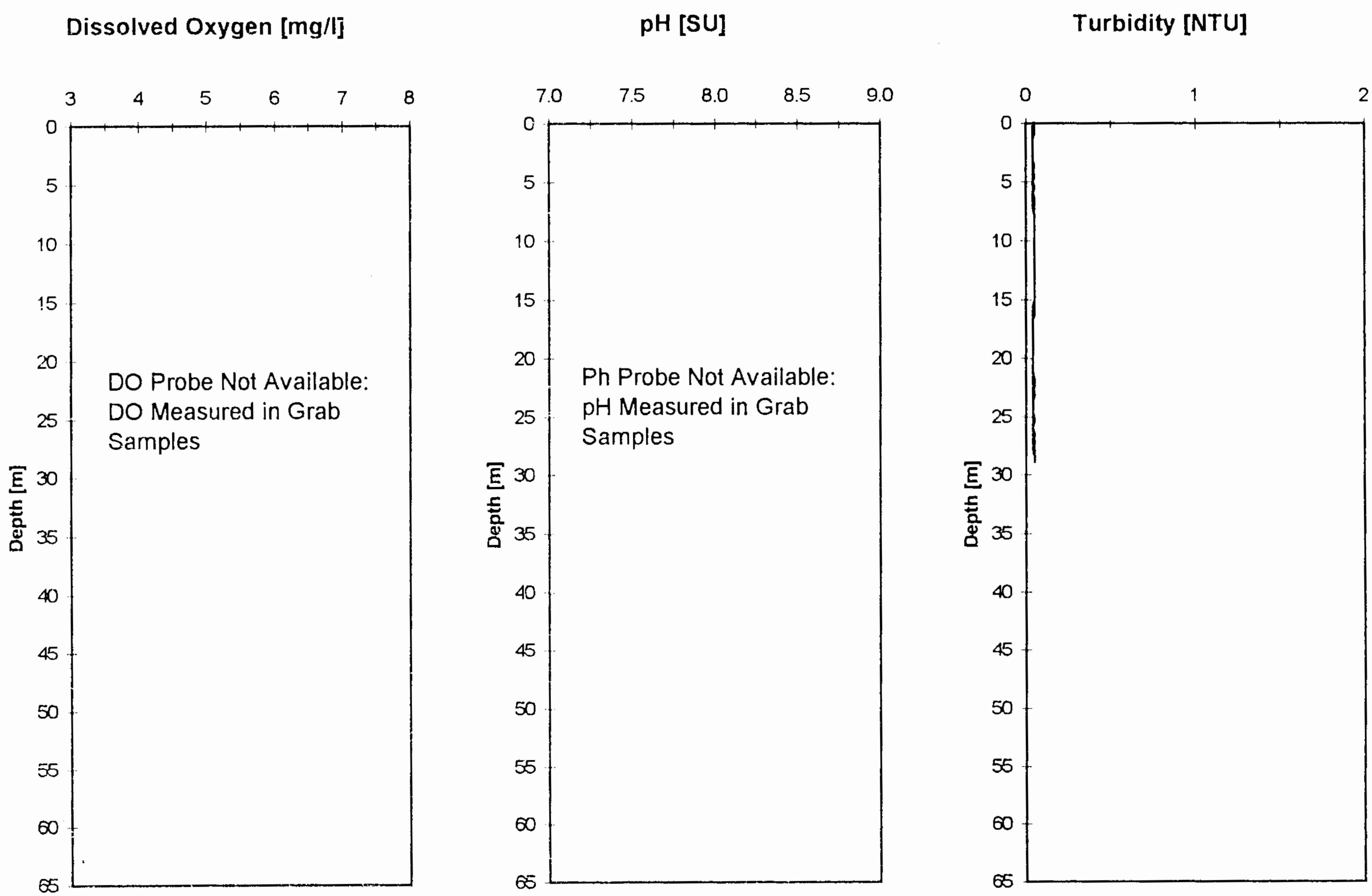
4 September 1997



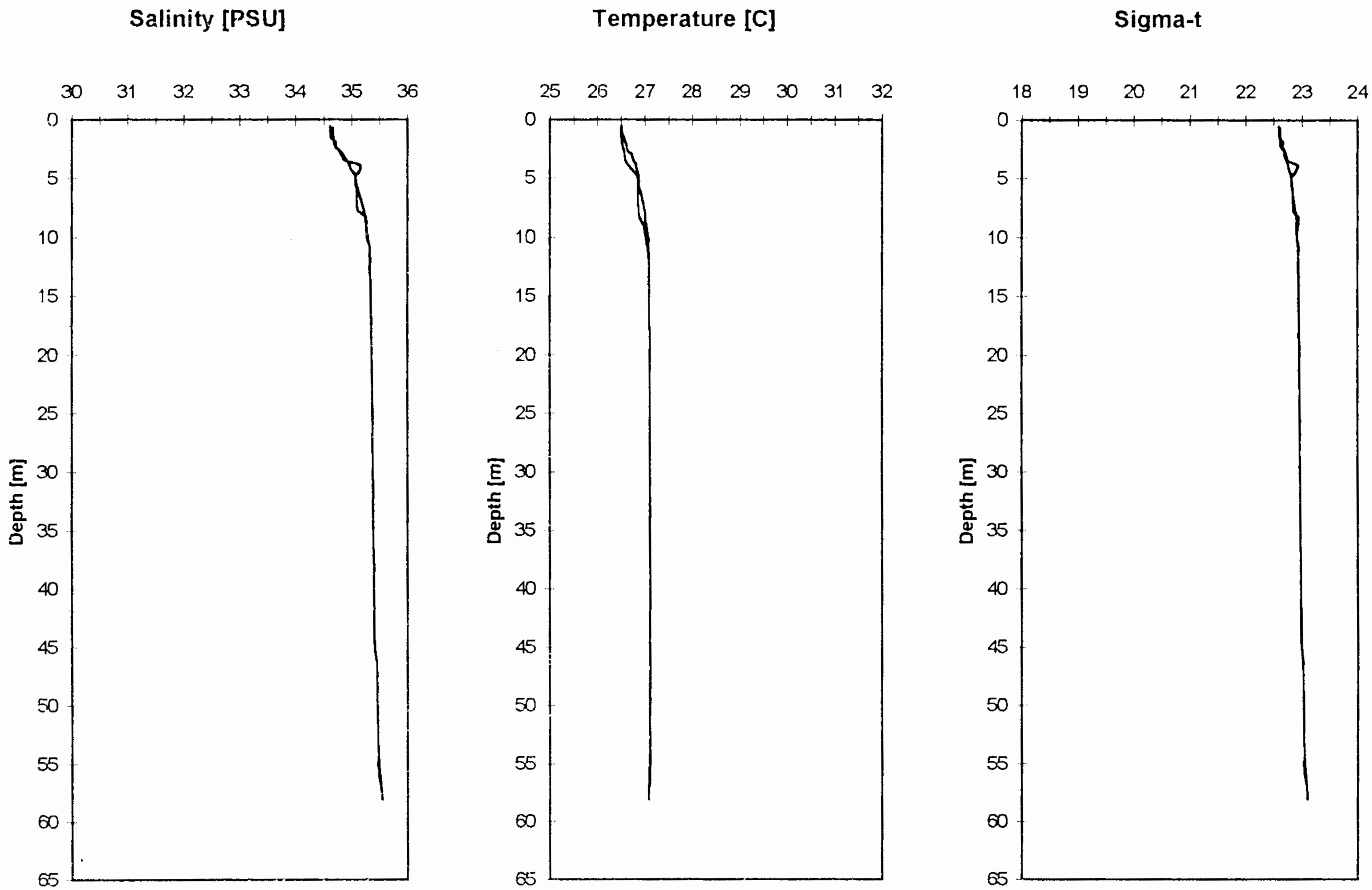
Station 16
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
4 September 1997



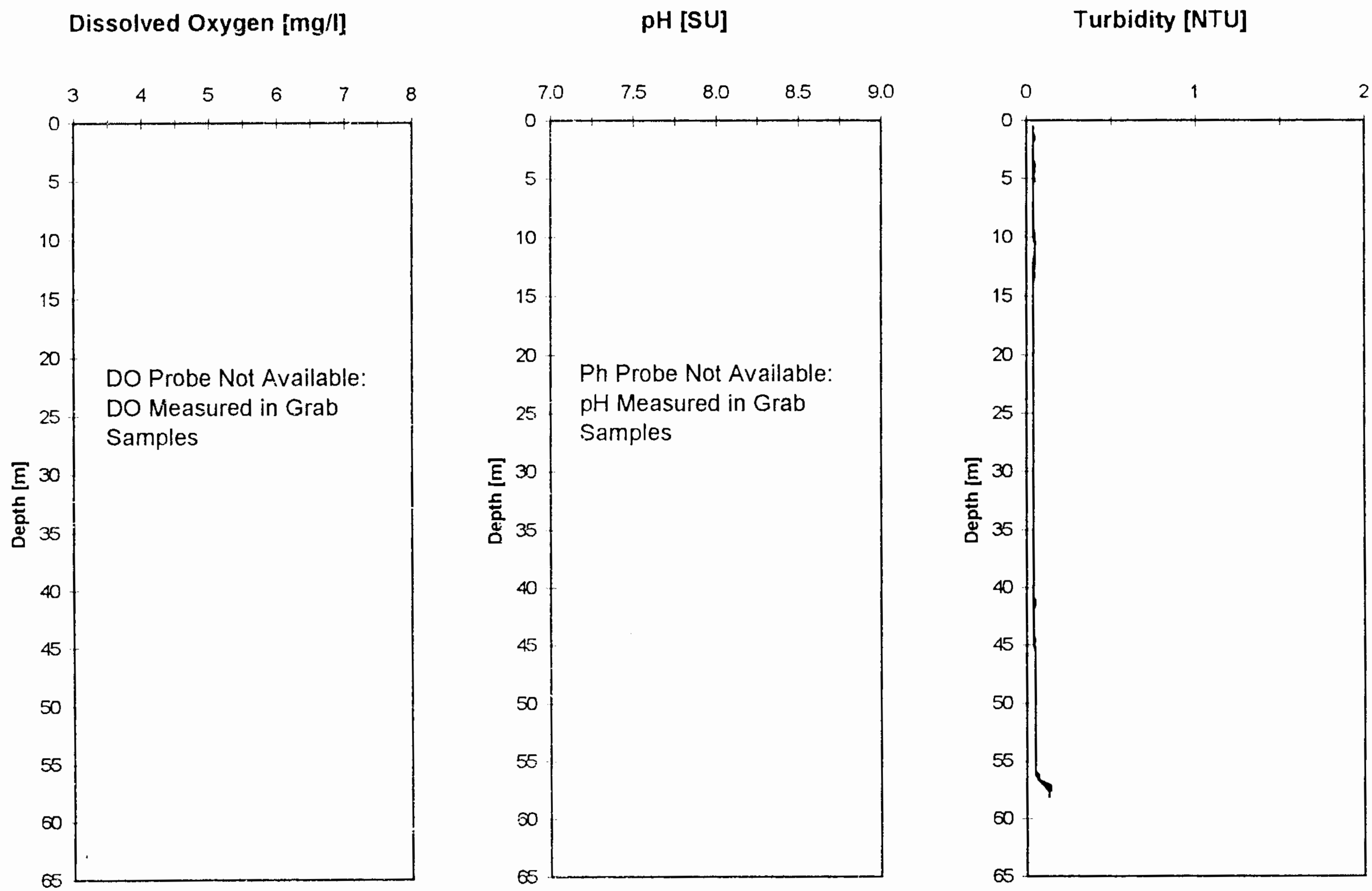
Station 17
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
4 September 1997



Station 17
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
4 September 1997



Station 18
Pago Pago Harbor Water Quality Monitoring Profiles
Salinity, Temperature, and Density
4 September 1997



Station 18
Pago Pago Harbor Water Quality Monitoring Profiles
Dissolved Oxygen, pH, and Turbidity
4 September 1997

Appendix IV

Chain-of-Custody Records
September 1997

Page 1 of 6

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091 .WQ.97

Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office: CH2M HILL

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

SHADED AREA – FOR LAB USE ONLY: Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver

ANALYSES REQUESTED

	Sampling Date (97)	Time	COMP	GRAB	WATER	SOIL	AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	Ammonia (350.1)	Nitrite (353.2)	Nitrate (353.2)	TKN @ DL of 0.05 mg/l (351.3)	Total Phosphorus (356.2)	REMARKS	LAB 1 ID	LAB 2 ID	
055	8/31			X	X			13-SURF	2	X	X	X	X	X	SEAWATER			QC
056								13-15										QC
057								13-BOTM										
058								12-SURF										
059								12-50										
060								12-BOTM										
061								11-SURF										
062								11-30										
063								11-60										
064								11-90										
065								11-120										QC

Sampled By & Title (Please sign and print name): S. Costa — Date/Time: 8/31/97

Relinquished By (Please sign and print name): S. Costa — Date/Time: 9/1/97

Received By (Please sign and print name): H. Downy H. Downy — Date/Time: 9/4/97 1020

Relinquished By (Please sign and print name): — Date/Time:

Received By (Please sign and print name): — Date/Time:

Relinquished By (Please sign and print name): — Date/Time:

QC Level: 1 2 3 Other: ____

COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Received By (Please sign and print name): — Date/Time:

Shipped Via: UPS BUS Fed-Ex Hand Other DHL

Shipping #:

Work Authorized By (Please sign and print name):

Remarks: TKN @ Detect Limit of 0.05 mg/l

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/94 FORM 340

Page 2 of 6

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091 WQ 97

Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

SHADED AREA – FOR LAB USE ONLY: Lab 1 # / Lab 2 # / Quote # / Kit Request # / Project # / No. of Samples / Page of / Login / LIMS Ver

ANALYSES REQUESTED

Sampling Date (97)	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	AMMONIA (350.1)	NITRITE (353.2)	NITRATE (353.2)	TKN @ DL of 0.05 mg/l (351.3)	TOTAL PHOSPHORUS (365.2)	REMARKS	LAB 1 ID	LAB 2 ID
8/31			X	X			11-BOTM	2	X	X	X	X	X	SEAWATER		
↓			↓	↓			10-SURF	↓	↓	↓	↓	↓	↓	↓		
							10-30									
							10-60									
							10-90									
							10-120									
							10-BOTM									
							10A-SURF									
							10A-30									
							10A-60									
							10A-BOTM									

Sampled By & Title (Please sign and print name): S.H. Costa	Date/Time: 8/31/97	Relinquished By (Please sign and print name): S.H. Costa	Date/Time: 9/1/97
Received By (Please sign and print name): H. Downing H. Downing	Date/Time: 9/3/97 1030	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via: UPS BUS Fed-Ex Hand Other DHL	Shipping #
Work Authorized By (Please sign and print name)	Remarks: TKN @ Detect Limit of 0.05 mg/l		

QC Level: 1 2 3 Other: ____

COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client
REV 3/94 FORM 340

Page ? of 12

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091 WQ 97
Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

SHADED AREA – FOR LAB USE ONLY: Lab 1 # / Lab 2 # / Quote # / Kit Request # / Project # / No. of Samples / Page of / Login / LIMS Ver

ANALYSES REQUESTED

	Sampling Date	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	AMMONIA (350.1)	NITRITE (353.2)	NITRATE (353.2)	TKN @ DL of 0.05 mg/l (351.3)	TOTAL PHOSPHORUS (356.2)	REMARKS	LAB 1 ID	LAB 2 ID
077	8/31			X	X			11A-SURF	2	X	X	X	X	X	SEAWATER		
078								11A-30									
079								11A-60									
080								11A-90									
084								11A-120									
081								11A-BOTM									
083								9-SURF									
084								9-30									
085								9-60									
086								9-BOTM									
087								9A-SURF									

Sampled By & Title (Please sign and print name): S. Costa — Date/Time: 8/31/97

Relinquished By (Please sign and print name): S. Costa — Date/Time: 9/1/97

Received By (Please sign and print name): H. Downing H Downing — Date/Time: 9/4/97 1030

Relinquished By (Please sign and print name): — Date/Time:

Received By (Please sign and print name): — Date/Time:

Relinquished By (Please sign and print name): — Date/Time:

QC Level: 1 2 3 Other: ____

COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Received By (Please sign and print name): — Date/Time:

Shipped Via: UPS BUS Fed-Ex Hand Other ____

Shipping #:

Work Authorized By (Please sign and print name):

Remarks: TKN at detection limit of 0.05 mg/l

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client
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PAGE 1 of 4

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091.WQ.~~97~~

Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

SHADED AREA – FOR LAB USE ONLY: Lab 1 #, Lab 2 #, Quote #, Kit Request #, Project #, No. of Samples, Page of, Login, LIMS Ver

ANALYSES REQUESTED

	Sampling Date ('97)	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	AMMONIA (350.1)	NITRITE (353.2)	NITRATE (353.2)	TKN@DL of 0.05mg/L (351.3)	TOTAL PHOSPHORUS (365.2)	REMARKS	LAB 1 ID	LAB 2 ID
1088	8/31			X	X			9A-30	2	X	X	X	X	X	SEAWATER		
89								9A-60									
90								9A-BOTM									
91	9/1							5-SURF									
92								5-30									
93								5-60									
94								5-120									
95								5-90									
96								5-BOTM									
97								5A-SURF									
98								5A-30									

Sampled By & Title (Please sign and print name): S Costa — Date/Time: 9/1/97 8/31/97

Relinquished By (Please sign and print name): S Costa — Date/Time: 9/1/97

Received By (Please sign and print name): H. Doring H Doring — Date/Time: 9/2/97 10:30

Relinquished By (Please sign and print name): — Date/Time:

Received By (Please sign and print name): — Date/Time:

Relinquished By (Please sign and print name): — Date/Time:

Received By (Please sign and print name): — Date/Time:

QC Level: 1 2 3 Other: ______

COC Rec	ICE
Ana Req	TEMP
Cust Seal	Ph

Shipped Via: UPS BUS Fed-Ex Hand Other DHL

Shipping #:

Work Authorized By (Please sign and print name):

Remarks: TKN @ Detect Limit of 0.05 mg/l

Instructions and Agreement Provisions on Reverse Side

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REV 3/94 FORM 340

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091 WQ97

Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

SHADED AREA – FOR LAB USE ONLY: Lab 1 # / Lab 2 # / Quote # / Kit Request # / Project # / No. of Samples / Page of / Login / LIMS Ver

ANALYSES REQUESTED

	Sampling Date (97)	Time	COMP	GRAB	WATER	SOIL	AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	AMMONIA (350.1)	NITRITE (353.2)	NITRATE (353.2)	TKN @ DL of 0.05 mg/l (351.3)	TOTAL PHOSPHORUS (356.2)	TURBIDITY*				REMARKS	LAB 1 ID	LAB 2 ID
2099	9/1			X	X			5A-60	2	X	X	X	X	X					SEAWATER		
100								5A-90													
101								5A-120													
102								5A-BOTM													
103								15-SURF							X						
104								15-50							X						
105								15-BOTM							X						
106								16-SURF							X						
107								16-30							X						
108								16-60							X						
109								16-90							X						

Sampled By & Title (Please sign and print name): S. Costa — Date/Time: 9/1/97

Relinquished By (Please sign and print name): S. Costa — Date/Time: 9/1/97

Received By (Please sign and print name): H. Dawny H. Dawny — Date/Time: 9/4/97 1030

Relinquished By (Please sign and print name): — Date/Time:

Received By (Please sign and print name): — Date/Time:

Relinquished By (Please sign and print name): — Date/Time:

QC Level: 1 2 3 Other: ____

COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Received By (Please sign and print name): — Date/Time:

Shipped Via: UPS BUS Fed-Ex Hand Other DHL

Shipping #:

Work Authorized By (Please sign and print name):

Remarks: TKN @ DL of 0.05 mg/l / *TURBIDITY ON STATIONS 15 & 16 & 18

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/94 FORM 340

PAL-6 ⅰ 4

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091 WQ 97

Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

SHADED AREA – FOR LAB USE ONLY

Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver

ANALYSES REQUESTED: AMMONIA (350.1) | NITRITE (353.2) | NITRATE (353.2) | TKN @ DL of 0.05 mg/l (351.3) | TOTAL PHOSPHORUS (356.2) | TURBIDITY (*)

	Sampling Date ('97)	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	AMMONIA (350.1)	NITRITE (353.2)	NITRATE (353.2)	TKN @ DL of 0.05 mg/l (351.3)	TOTAL PHOSPHORUS (356.2)	TURBIDITY (*)					REMARKS	LAB 1 ID	LAB 2 ID
2110	9/1			X	X			16-120	2	X	X	X	X	X	X					SEAWATER		
11								16-BOTM														
12								18-SURF														
13								18-30														
14								18-60														
15								18-120														
16								18-BOTM														
12L								18-90												NOT ON CHAIN OF CUSTODY, ALTHOUGH BOTTLES WERE RECEIVED		

Sampled By & Title (Please sign and print name): S. Costa — Date/Time: 9/1/97

Relinquished By (Please sign and print name): S. Costa — Date/Time: 9/1/97

Received By (Please sign and print name): W. Davi H Dawning — Date/Time: 9/4/97 1030

Relinquished By (Please sign and print name): — Date/Time:

Received By (Please sign and print name): — Date/Time:

Relinquished By (Please sign and print name): — Date/Time:

Received By (Please sign and print name): — Date/Time:

Shipped Via: UPS BUS Fed-Ex Hand Other DHL

Shipping #:

QC Level: 1 2 3 Other: ____

COC Rec | ICE | Ana Req | TEMP | Cust Seal | Ph

Work Authorized By (Please sign and print name):

Remarks: TKN @ DL of 0.05 mg/l / *TURBIDITY ON STATIONS 15, 16, 18

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/94 FORM 340

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091 .W9.97

Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

SHADED AREA– FOR LAB USE ONLY: Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver

ANALYSES REQUESTED: Chlorophyll a

Sampling 97 Date	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	Chlorophyll a	REMARKS	LAB 1 ID	LAB 2 ID
9/1			X	X			5-SURF	1	X	1l filtered		
							5-30					
							5-60					
							5-90					
							5-120					
							5-BOTM					
							5A-SURF					
							5A-30					
							5A-60					
							5A-90					
							5A-120					

Sampled By & Title (Please sign and print name)	Date/Time 8/31-9/3/97	Relinquished By (Please sign and print name) David Wilson	Date/Time 9/8/97 1200
Received By (Please sign and print name)	Date/Time 9/8/97 1200	Relinquished By (Please sign and print name)	Date/Time 9/8/97 1300
Received By (Please sign and print name)	Date/Time 9/8/97 1300	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via: UPS BUS Fed-Ex Hand Other ____	Shipping #
Work Authorized By (Please sign and print name)	Remarks		

QC Level: 1 2 3 Other: ____

COC Rec	ICE
Ana Req	TEMP
Cust Seal	Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

PAGE 1 of 1

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091.WQ.97

Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

ANALYSES REQUESTED: Chlorophyll-a

SHADED AREA– FOR LAB USE ONLY: Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver

Sampling 9-7

Date	Time	COMP	GRAB	WATER	SOIL	AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	Chlorophyll-a	REMARKS	LAB 1 ID	LAB 2 ID
9/1			X	X			5A-BOTM	1	X	1l filtered		
9/2							6-SURF					
							6-30					
							6-60					
							6-90					
							6-120					
							6-BOTM					
							6A-SURF					
							6A-30					
							6A-60					
							6A-90					

Sampled By & Title (Please sign and print name): [signature] — Date/Time: 8/31-9/3/97

Relinquished By (Please sign and print name): [signature], David Wilson — Date/Time: 9/8/97/1200

Received By (Please sign and print name): [signature] — Date/Time: 9/8/97 1200

Relinquished By (Please sign and print name): [signature] — Date/Time: 9/8/97 13:00

Received By (Please sign and print name): [signature] — Date/Time: 9/8/97/1300

Relinquished By (Please sign and print name): — Date/Time:

Received By (Please sign and print name): — Date/Time:

Shipped Via: UPS BUS Fed-Ex Hand Other ____ — Shipping #:

QC Level: 1 2 3 Other: ____

COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Work Authorized By (Please sign and print name):

Remarks:

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client
REV 3/94 FORM 340

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

1 Page 1 of 1

CH2M Hill Project #: 107091.W9.97

Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES / ANALYSES REQUESTED: Chlorophyll a

SHADED AREA-- FOR LAB USE ONLY: Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver

Sampling Date (97)	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	Chlorophyll a	REMARKS	LAB 1 ID	LAB 2 ID
9/2			X	X			6A-BOTM	1	X	1l filtered		
							7-SURF					
							7-30					
							7-60					
							7-90					
							7-BOTM					
							8-SURF					
							8-30					
							8-60					
							8-90					
							8-120					

Sampled By & Title (Please sign and print name): [signature]	Date/Time: 8/31-9/3/97	Relinquished By (Please sign and print name): [signature] David Wilson	Date/Time: 9/8/97 1200
Received By (Please sign and print name): [signature]	Date/Time: 9/8/97 1200	Relinquished By (Please sign and print name): [signature]	Date/Time: 9/8/97 1300
Received By (Please sign and print name): M.C. [signature]	Date/Time: 9/8/97 1300	Relinquished By (Please sign and print name):	Date/Time:
Received By (Please sign and print name):	Date/Time:	Shipped Via: UPS BUS Fed-Ex Hand Other ____	Shipping #:
Work Authorized By (Please sign and print name):	Remarks:		

QC Level: 1 2 3 Other: ____

COC Rec	ICE
Ana Req	TEMP
Cust Seal	Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/94 FORM 340

PAGE 4 OF [illegible]

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091. W9.97

Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707 826 0717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

ANALYSES REQUESTED: Chlorophyll-a

SHADED AREA-- FOR LAB USE ONLY

Lab 1 #: | Lab 2 #:
Quote #: | Kit Request #:
Project #:
No. of Samples: | Page of
Login: | LIMS Ver

Sampling Date (97)	Time	Type: COMP	Type: GRAB	Matrix: WATER	Matrix: SOIL	Matrix: AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	Chlorophyll-a	REMARKS	LAB 1 ID	LAB 2 ID
9/2			X	X			8-BOTM	1	X	1l filtered		
							8A-SURF					
							8A-30					
							8A-60					
							8A-90					
							8A-120					
							8A-BOTM					
8/31							9-SURF					
							9-30					
							9-60					
							9-BOTM					

Sampled By & Title (Please sign and print name): [signature] | Date/Time: 8/31-9/3/97

Relinquished By (Please sign and print name): [signature] David Wilson | Date/Time: 9/8/97 1200

Received By (Please sign and print name): [signature] | Date/Time: 9/8/97 1200

Relinquished By (Please sign and print name): [signature] | Date/Time: 9/8/97 1302

Received By (Please sign and print name): M.G. [signature] | Date/Time: 9/8/97 1302

Relinquished By (Please sign and print name): | Date/Time:

Received By (Please sign and print name): | Date/Time:

Shipped Via: UPS BUS Fed-Ex Hand Other ____ | Shipping #:

QC Level: 1 2 3 Other: ____

COC Rec	ICE
Ana Req	TEMP
Cust Seal	Ph

Work Authorized By (Please sign and print name):

Remarks:

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/94 FORM 340

Page 3 of 1

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091.WQ.97

Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

SHADED AREA– FOR LAB USE ONLY

Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver

ANALYSES REQUESTED: Chlorophyll-a

Sampling Date (1997)	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	Chlorophyll-a	REMARKS	LAB 1 ID	LAB 2 ID
8/31			X	X			9A-SURF	1	X	2l filtered		
							9A-30					
							9A-60					
							9A-BOTM					
							10-SURF			1l filtered		
							10-30					
							10-60					
							10-90					
							10-120					
							10-BOTM					
							10A-SURF			2l filtered		

NOTE VOL Filtered

Sampled By & Title (Please sign and print name): [signature]	Date/Time: 8/31-9/2/97	Relinquished By (Please sign and print name): [signature] David Wilson	Date/Time: 9/8/97 1200
Received By (Please sign and print name): [signature]	Date/Time: 9/8/97 12W	Relinquished By (Please sign and print name): [signature]	Date/Time: 9/8/97 1300
Received By (Please sign and print name): M. C[illegible]	Date/Time: 9/8/97 1300	Relinquished By (Please sign and print name):	Date/Time:
Received By (Please sign and print name):	Date/Time:	Shipped Via: UPS BUS Fed-Ex Hand Other ____	Shipping #:
Work Authorized By (Please sign and print name):	Remarks:		

QC Level: 1 2 3 Other: ____

COC Rec	ICE
Ana Req	TEMP
Cust Seal	Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/94 FORM 340

CH2M HILL

PAGE 20 1

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091.W9.97

Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA ☐ NPDES ☒ RCRA ☐ OTHER ____

Sample Disposal: Dispose ☐ Return ☐

OF CONTAINERS

LAB TEST CODES

ANALYSES REQUESTED: Chlorophyll -a

SHADED AREA-- FOR LAB USE ONLY

Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver

Sampling 1997 Date	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	Chlorophyll -a	REMARKS	LAB 1 ID	LAB 2 ID
8/31			X	X			10A-30	1	X	2l filtered		
↓			↓	↓			10A-60	↓	↓	1l filtered		
↓			↓	↓			10A-BOTM	↓	↓	↓		
↓			↓	↓			11-SURF	↓	↓	↓		
↓			↓	↓			11-30	↓	↓	↓		
↓			↓	↓			11-60	↓	↓	↓		
↓			↓	↓			11-90	↓	↓	↓		
↓			↓	↓			11-120	↓	↓	↓		
↓			↓	↓			11-BOTM	↓	↓	↓		
↓			↓	↓			11A-SURF	↓	↓	↓		
↓			↓	↓			11A-30	↓	↓	↓		

NOTE VOLUME FILTERED

Sampled By & Title (Please sign and print name): [signature] — Date/Time: 8/31-9/2 97

Relinquished By (Please sign and print name): [signature] David Wilson — Date/Time: 9/8/97 1200

Received By (Please sign and print name): [signature] — Date/Time: 9/8/97 1200

Relinquished By (Please sign and print name): [signature] — Date/Time: 9/8/97 1300

Received By (Please sign and print name): Mc. C. [signature] — Date/Time: 9/8/97 1300

Relinquished By (Please sign and print name): — Date/Time:

Received By (Please sign and print name): — Date/Time:

Shipped Via: UPS BUS Fed-Ex Hand Other ____

Shipping #:

Work Authorized By (Please sign and print name):

Remarks:

QC Level: 1 2 3 Other: ____

COC Rec | ICE | Ana Req | TEMP | Cust Seal | Ph

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091 W9.97
Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707 826 0717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

ANALYSES REQUESTED: Chlorophyll-a

SHADED AREA – FOR LAB USE ONLY: Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver

Sampling 1997 Date	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	Chlorophyll-a	REMARKS	LAB 1 ID	LAB 2 ID
8/31			X	X			11A-60	1	X	1 liter filtered		
							11A-~~[illegible]~~90					
							11A-120					
							11A-BOTM					
							12-SURF					
							12-50					
							12-BOTM					
							13-SURF					
							13-15					
							13-BOTM					
9/2							14-SURF					

Sampled By & Title (Please sign and print name): S. Costa | Date/Time: 8/31-9/2/97

Relinquished By (Please sign and print name): [signature] David Wilson | Date/Time: 9/8/97 1200

Received By (Please sign and print name): [signature] | Date/Time: 9/8/97 1200

Relinquished By (Please sign and print name): [signature] | Date/Time: 9/8/97 1300

Received By (Please sign and print name): Eric C. [signature] | Date/Time: 9/8/97 1300

Relinquished By (Please sign and print name): | Date/Time:

Received By (Please sign and print name): | Date/Time:

Shipped Via: UPS BUS Fed-Ex Hand Other ____ | Shipping #

QC Level: 1 2 3 Other: ____

COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Work Authorized By (Please sign and print name): | Remarks

Instructions and Agreement Provisions on Reverse Side

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REV 3/94 FORM 340

Page 3 of I

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091 W9.97

Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707 8260717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

SHADED AREA– FOR LAB USE ONLY: Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver

ANALYSES REQUESTED: Chlorophyll a

Sampling 1997 Date	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	Chlorophyll a	REMARKS	LAB 1 ID	LAB 2 ID
9/2			X	X			14-30	1	X	1l filtered		
							14-60					
							14-90					
							14-120					
							14-BOTM					
9/1							15-SURF			2l filtered		
							15-50					
							15-BOTM					
							16-SURF			1l filtered		
							16-30					
							16-60					

NOTE VOLUME FILTERED

Sampled By & Title (Please sign and print name): S. Costa — Date/Time: 8/31-9/2/97

Relinquished By (Please sign and print name): D.F. Wilson David Wilson — Date/Time: 9/8/97 1200

Received By (Please sign and print name): [illegible] — Date/Time: 9/8/97 1200

Relinquished By (Please sign and print name): [illegible] — Date/Time: 9/8/97 1500

Received By (Please sign and print name): M.C. [illegible] — Date/Time: 9/8/97 1300

Relinquished By (Please sign and print name): — Date/Time:

Received By (Please sign and print name): — Date/Time:

Shipped Via: UPS BUS Fed-Ex Hand Other ____

Shipping #:

QC Level: 1 2 3 Other: ____

COC Rec | ICE | Ana Req | TEMP | Cust Seal | Ph

Work Authorized By (Please sign and print name):

Remarks:

Instructions and Agreement Provisions on Reverse Side

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REV 2/94 FORM 240

Page 4 of 1

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091 WQ.97

Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA ☐ NPDES ☒ RCRA ☐ OTHER ____

Sample Disposal: Dispose ☐ Return ☐

LAB TEST CODES

ANALYSES REQUESTED: Chlorophyll a

SHADED AREA – FOR LAB USE ONLY: Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	Chlorophyll a	REMARKS	LAB 1 ID	LAB 2 ID
9/1			X	X			16-90	1	x	1l filtered		
							16-120					
							16-BOTM					
9/2							17-SURF					
							17-30					
							17-BOTM					
9/1							18-SURF					
							18-30			1.5l filtered		
							18-60			2l filtered		
							18-90			1.5l filtered		
							~~18-120~~			~~2l filtered~~		
							~~18-BOTM~~			2l filtered		

NOTE VOLUME FILTERED

Sampled By & Title (Please sign and print name) | Date/Time 8/31-9/1/97

Relinquished By (Please sign and print name) David Wilson | Date/Time 9/8/97 1200

Received By (Please sign and print name) | Date/Time 9/8/97 1200

Relinquished By (Please sign and print name) | Date/Time 9/8/97 1300

Received By (Please sign and print name) | Date/Time 9/8/97 1300

Relinquished By (Please sign and print name) | Date/Time

QC Level: 1 2 3 Other: ____

COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Received By (Please sign and print name) | Date/Time

Shipped Via: UPS BUS Fed-Ex Hand Other ____

Shipping #

Work Authorized By (Please sign and print name)

Remarks

Instructions and Agreement Provisions on Reverse Side

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REV 3/94 FORM 340

PAG 1 of 4

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091 WQ 97

Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA ☐ NPDES ☒ RCRA ☐ OTHER ____

Sample Disposal: Dispose ☐ Return ☐

LAB TEST CODES

SHADED AREA– FOR LAB USE ONLY: Lab 1 # / Lab 2 # / Quote # / Kit Request # / Project # / No. of Samples / Page of / Login / LIMS Ver

ANALYSES REQUESTED

	Sampling Date ('97)	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	AMMONIA (350.1)	NITRITE (353.2)	NITRATE (353.2)	TKN@DL 0.05mg/l (351.3)	TOTAL PHOSPHORUS (356.2)						REMARKS	LAB 1 ID	LAB 2 ID
2353	9/2			X	X			6-SURF	2	X	X	X	X	X						SEAWATER		
54								6-30														
55								6-60														
56								6-90														
57								6-120														
58								6-BOTM														
59								6A-SURF														
60								6A-30														
61								6A-60														
62								6A-90														
63								6A-BOTM														

Sampled By & Title (Please sign and print name): S. Costa — Date/Time: 9/2/97

Relinquished By (Please sign and print name): S. Costa — Date/Time: 9/5/97

QC Level: 1 2 3 Other: ____

Received By (Please sign and print name) — Date/Time

Relinquished By (Please sign and print name) — Date/Time

COC Rec / ICE

Received By (Please sign and print name) — Date/Time

Relinquished By (Please sign and print name) — Date/Time

Ana Req / TEMP

Cust Seal / Ph

Received By (Please sign and print name) — Date/Time

Shipped Via: UPS BUS Fed-Ex Hand Other DHL

Shipping #

Work Authorized By (Please sign and print name)

Remarks: TKN @ Detection Limit of 0.05 mg/l

Instructions and Agreement Provisions on Reverse Side

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CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091 W9 97

Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA ☐ NPDES ☒ RCRA ☐ OTHER ____

Sample Disposal: Dispose ☐ Return ☐

LAB TEST CODES

SHADED AREA – FOR LAB USE ONLY: Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver

ANALYSES REQUESTED

	Sampling Date	Time	Type: COMP	Type: GRAB	Matrix: WATER	Matrix: SOIL	Matrix: AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	AMMONIA (350.1)	NITRITE (353.2)	NITRATE (353.2)	TKN@DL 0.05 mg/l (351.3)	TOTAL PHOSPHORUS (356.2)	TURBIDITY*				REMARKS	LAB 1 ID	LAB 2 ID
2364	9/2			X	X			7-SURF	2	X	X	X	X	X					SEAWATER		
65	↓			↓	↓			7-30	↓	↓	↓	↓	↓	↓					↓		
66	↓			↓	↓			7-60	↓	↓	↓	↓	↓	↓					↓		
67	↓			↓	↓			7-90	↓	↓	↓	↓	↓	↓					↓		
68	↓			↓	↓			7-BOTM	↓	↓	↓	↓	↓	↓					↓		
69	↓			↓	↓			8-SURF	↓	↓	↓	↓	↓	↓	X				↓		
70	↓			↓	↓			8-30	↓	↓	↓	↓	↓	↓	X				↓		
71	↓			↓	↓			8-60	↓	↓	↓	↓	↓	↓	X				↓		
72	↓			↓	↓			8-90	↓	↓	↓	↓	↓	↓	X				↓		
73	↓			↓	↓			8-120	↓	↓	↓	↓	↓	↓	X				↓		
74	↓			↓	↓			8-BOTM	↓	↓	↓	↓	↓	↓	X				↓		

Sampled By & Title (Please sign and print name) S. Costa	Date/Time 9/2/97	Relinquished By (Please sign and print name) S. Costa	Date/Time 9/5/97	QC Level: 1 2 3 Other:	
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time	COC Rec	ICE
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time	Ana Req	TEMP
				Cust Seal	Ph
Received By (Please sign and print name)	Date/Time	Shipped Via UPS BUS Fed-Ex Hand Other DHL	Shipping #		
Work Authorized By (Please sign and print name)	Remarks TKN @ DL of 0.05 mg/l / *TURBIDITY @ STATIONS 8, 8A, 14, 17				

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091 WQ 97
Purchase Order #:
Project Name: JCO HARBOR MONITORING
Company Name/CH2M HILL Office:
Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717
Report Copy to: SAME
Requested Completion Date:
Sampling Requirements: SDWA ☐ NPDES ☒ RCRA ☐ OTHER ___
Sample Disposal: Dispose ☐ Return ☐

LAB TEST CODES

ANALYSES REQUESTED: AMMONIA (350.1); NITRITE (353.2); NITRATE (353.2); TKN @ DL 0.05 mg/l (351.3); TOTAL PHOSPHORUS (356.2); TURBIDITY*

SHADED AREA – FOR LAB USE ONLY: Lab 1 # / Lab 2 # / Quote # / Kit Request # / Project # / No. of Samples / Page of / Login / LIMS Ver

	Date	Time	COMP	GRAB	WATER	SOIL	AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	Ammonia (350.1)	Nitrite (353.2)	Nitrate (353.2)	TKN @ DL 0.05 mg/l (351.3)	Total Phosphorus (356.2)	Turbidity*	REMARKS	LAB 1 ID	LAB 2 ID
2375	9/2			X	X			8A-SURF	2	X	X	X	X	X	X	SEAWATER		
76								8A-30										
77								8A-60										
78								8A-90										
79								8A-120										
80								8A-BOTM										
81								14-SURF										
82								14-30										
83								14-60										
84								14-90										
85								14-120										

Sampled By & Title (Please sign and print name): S. Costa — Date/Time: 9/2/97
Relinquished By (Please sign and print name): S. Costa — Date/Time: 9/5/97
Received By (Please sign and print name): — Date/Time:
Relinquished By (Please sign and print name): — Date/Time:
Received By (Please sign and print name): — Date/Time:
Relinquished By (Please sign and print name): — Date/Time:
Received By (Please sign and print name): — Date/Time:
QC Level: 1 2 3 Other: ___
COC Rec / ICE / Ana Req / TEMP / Cust Seal / Ph
Shipped Via: UPS BUS Fed-Ex Hand Other DHL
Shipping #:
Work Authorized By (Please sign and print name):
Remarks: TKN @ DL of 0.05 mg/l / *TURBIDITY @ STATIONS 8, 8A, 14, 17

Instructions and Agreement Provisions on Reverse Side

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[illegible] of [illegible]

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091 . WQ . 97

Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

SHADED AREA – FOR LAB USE ONLY: Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver

ANALYSES REQUESTED

	Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	AMMONIA (350.1)	NITRITE (353.2)	NITRATE (353.2)	TKN @ DL 0.05mg/l (351.3)	TOTAL PHOSPHORUS (365.2)	TURBIDITY *					REMARKS	LAB 1 ID	LAB 2 ID
1386	9/2			X	X			14-BOTM	2	X	X	X	X	X	X					SEAWATER		
87								17-SURF														
88								17-30														
89								17-BOTM														

Sampled By & Title (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
S. Costa	9/2/97	S. Costa	9/5/97
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via: UPS BUS Fed-Ex Hand Other DHL	Shipping #
Work Authorized By (Please sign and print name)	Remarks: TKN @ DL of 0.05 mg/l / *TURBIDITY @ STATIONS 8, 8A, 14, 17		

QC Level: 1 2 3 Other: ______

COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Instructions and Agreement Provisions on Reverse Side

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97-15606 TO 97-15619

COOLER TEMP. 7,8 °C

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091 WQ 97

Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA ☐ NPDES ☒ RCRA ☐ OTHER ____

Sample Disposal: Dispose ☐ Return ☐

LAB TEST CODES

SHADED AREA – FOR LAB USE ONLY: Lab 1 # / Lab 2 # / Quote # / Kit Request # / Project # / No. of Samples / Page of / Login / LIMS Ver

ANALYSES REQUESTED: COPPER-EPA220.2 * ; ZINC-EPA 200.7 **

* Copper detect. limit < 2 μg/l by coprecip

** Zinc detect limit < 20 μg/l

Sampling Date (97)	Time	Type: COMP	Type: GRAB	Matrix: WATER	Matrix: SOIL	Matrix: AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	COPPER-EPA220.2 *	ZINC-EPA 200.7 **	REMARKS	LAB 1 ID	LAB 2 ID
8/31			X	X			13-SURF	2	X	X	1/2 liter presrvd		
↓			↓	↓			13-BOTM	↓	↓	↓	with HNO_3		
↓			↓	↓			11-~~SURF~~ 120	↓	↓	↓	1/2 liter		
↓			↓	↓			11-30	↓	↓	↓	unpreserved		
↓			↓	↓			11-BOTM	↓	↓	↓	for co-precip		

Sampled By & Title (Please sign and print name): S K Costa — Date/Time: 8/31/97

Relinquished By (Please sign and print name): SK Costa — Date/Time: 9/1/97

Received By (Please sign and print name): Jeff J. Reitan — Date/Time: 9/4/97

Relinquished By (Please sign and print name): — Date/Time:

Received By (Please sign and print name): — Date/Time:

Relinquished By (Please sign and print name): — Date/Time:

Received By (Please sign and print name): — Date/Time:

QC Level: 1 2 3 Other: ____

COC Rec | ICE

Ana Req | TEMP

Cust Seal | Ph

Shipped Via: UPS BUS Fed-Ex Hand Other DHL

Shipping #:

Work Authorized By (Please sign and print name):

Remarks: SEAWATER SAMPLES - SAVE EXTRA SAMPLE FOR POSSIBLE RETEST

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/94 FORM 240

00003

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091 WQ 97

Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

ANALYSES REQUESTED: *Copper EPA 220.2; *Zinc EPA 200.7

*Copper detect. limit <2µg/l by co-precipitation

**Zinc detection limit <20µg/l

SHADED AREA – FOR LAB USE ONLY: Lab 1 #; Lab 2 #; Quote #; Kit Request #; Project #; No. of Samples; Page of; Login; LIMS Ver

Sampling Date (97)	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	*Copper EPA 220.2	*Zinc EPA 200.7	REMARKS	LAB 1 ID	LAB 2 ID
9/1			X	X			5-30	2	X	X	1 bottle w/HNO3		
↓			↓	↓			5-120	↓	↓	↓	1 bottle unpreserved		
↓			↓	↓			5-BOTM	↓	↓	↓	for coprecip		
↓			↓	↓			5A-30	↓	↓	↓			
↓			↓	↓			5A-120	↓	↓	↓			
↓			↓	↓			5A-BOTM	↓	↓	↓			

Sampled By & Title (Please sign and print name): S. Costa	Date/Time: 9/1/97	Relinquished By (Please sign and print name): S. Costa	Date/Time: 9/1/97
Received By (Please sign and print name): Jeff J. Reitan	Date/Time: 9/4/97	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via: UPS BUS Fed-Ex Hand Other DHL	Shipping #
Work Authorized By (Please sign and print name)	Remarks: SEAWATER SAMPLES – SAVE EXTRA SAMPLE FOR POSSIBLE RETEST		

QC Level: 1 2 3 Other: ____

COC Rec | ICE

Ana Req | TEMP

Cust Seal | Ph

000004

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/94 FORM 240

PA - 3 - f

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091 WQ 97

Purchase Order #:

Project Name: JCO HARBOR MONITORING

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

SHADED AREA– FOR LAB USE ONLY: Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver

ANALYSES REQUESTED

*Copper detect limit < 2 ug/l by coprecipitation

**Zinc detection limit < 20 ug/l

Sampling 97 Date	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	*Copper EPA 220.2	**Zinc EPA 200.7	REMARKS	LAB 1 ID	LAB 2 ID
9/1			X	X			15-SURF	2	X	X	1 bottle w/HNO_3		
↓			↓	↓			15-50	↓	↓	↓	1 bottle unpreserved for copreci p		
							15-BOTM						
							16-30						
							16-120						
							16-BOTM						
							18-30						
							18-120						
							18-BOTM						

Sampled By & Title (Please sign and print name): S Costa — Date/Time: 9/1/97

Relinquished By (Please sign and print name): S Costa — Date/Time: 9/1/97

Received By (Please sign and print name): Jeff J. Reitan — Date/Time: 9/4/97

Relinquished By (Please sign and print name): — Date/Time:

Received By (Please sign and print name): — Date/Time:

Relinquished By (Please sign and print name): — Date/Time:

QC Level: 1 2 3 Other: ____

COC Rec | ICE | Ana Req | TEMP | Cust Seal | Ph

Received By (Please sign and print name): — Date/Time:

Shipped Via: UPS BUS Fed-Ex Hand Other DHL

Shipping #:

Work Authorized By (Please sign and print name):

Remarks: SEAWATER SAMPLES – SAVE EXTRA SAMPLE FOR POSSIBLE RETEST

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/94 FORM 340

Appendix V

Laboratory Report for Nutrients and Biological Parameters September 1997

AMTEST
LABORATORIES

AmTest Inc.
14603 N.E. 87th St.
Redmond, WA
98052
Tel: 425 885 1664
Fax: 425 883 3495

ANALYSIS REPORT

CH2M Hill
PO Box 91500
Bellevue, WA 98009-2050
Attention: Steve Costa

Date Received: 9/ 4/97
Date Reported: 10/ 7/97

Project Name: JCO Harbor Monit.
Project #: 107091.WQ.97
Date Sampled: 8/31/97

Saltwater Samples

PARAMETER	UNITS	RESULT
97-A012055		
Client ID: 13-SURF		
Chlorophyll a	mg/m3	2.1
Pheophytin	mg/m3	0.35
Ammonia Nitrogen	mg/l	0.034
Total Nitrogen	mg/l	0.091
Nitrate + Nitrite	mg/l	0.036
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.043
97-A012056		
Client ID: 13-15		
Chlorophyll a	mg/m3	0.64
Pheophytin	mg/m3	0.25
Ammonia Nitrogen	mg/l	0.073
Total Nitrogen	mg/l	0.12
Nitrate + Nitrite	mg/l	0.018
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.034
97-A012057		
Client ID: 13-BOTM		
Chlorophyll a	mg/m3	0.40
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	0.10
Total Nitrogen	mg/l	0.11
Nitrate + Nitrite	mg/l	0.016
Nitrite Nitrogen	mg/l	0.008
Total Phosphorus	mg/l	0.034
97-A012058		
Client ID: 12-SURF		
Chlorophyll a	mg/m3	1.8
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	0.052
Total Nitrogen	mg/l	0.12
Nitrate + Nitrite	mg/l	0.030
Nitrite Nitrogen	mg/l	0.010
Total Phosphorus	mg/l	0.034

AMTEST

ANALYSIS REPORT

CH2M Hill

Attention: Steve Costa

Date Received: 9/ 4/97
Date Reported: 10/ 7/97

Saltwater Samples

PARAMETER	UNITS	RESULT
97-A012103		
Client ID: 15-SURF		
Chlorophyll a	mg/m3	0.12
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.10
Nitrate + Nitrite	mg/l	0.011
Nitrite Nitrogen	mg/l	0.009
Total Phosphorus	mg/l	0.024
Turbidity	NTU	0.16
97-A012104		
Client ID: 15-50		
Chlorophyll a	mg/m3	0.23
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.001
Total Phosphorus	mg/l	0.026
Turbidity	NTU	0.08
97-A012105		
Client ID: 15-BOTM		
Chlorophyll a	mg/m3	1.0
Pheophytin	mg/m3	0.17
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.15
Nitrate + Nitrite	mg/l	0.014
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	0.019
Turbidity	NTU	0.10
97-A012106		
Client ID: 16-SURF		
Chlorophyll a	mg/m3	1.6
Pheophytin	mg/m3	0.79
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.18
Nitrate + Nitrite	mg/l	0.016
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.023
Turbidity	NTU	0.21

AMTEST

ANALYSIS REPORT

CH2M Hill

Attention: Steve Costa

Date Received: 9/ 4/97
Date Reported: 10/ 7/97

Saltwater Samples

PARAMETER	UNITS	RESULT
97-A012099		
Client ID: 5A-60		
Chlorophyll a	mg/m3	< 0.03
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.076
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.004
Total Phosphorus	mg/l	0.021
97-A012100		
Client ID: 5A-90		
Chlorophyll a	mg/m3	0.22
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.076
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	0.019
97-A012101		
Client ID: 5A-120		
Chlorophyll a	mg/m3	< 0.03
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.086
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.004
Total Phosphorus	mg/l	0.020
97-A012102		
Client ID: 5A-BOTM		
Chlorophyll a	mg/m3	0.45
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.079
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.009
Total Phosphorus	mg/l	0.021